WASTEWATER UTILITY
STANDARDS AND SPECIFICATIONS
TOWN OF CLEAR LAKE
STEUBEN COUNTY, INDIANA

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(260) 495-9158

Adopted by the Clear Lake Town Council
Resolution _____ on _____, 2017.

TABLE OF CONTENTS

STANDARD DETAILS

General Structures

PART 1 - INTRODUCTION

1.1 **General**

A. To promote consistency and uniformity in developments within the Town of Clear Lake ("Town") and for developments outside of the Town for which interconnection to the Clear Lake Wastewater Utility will be requested, the following procedures shall be followed:

B. All applications for commercial, industrial, and residential plats and development plans shall be submitted to the Clear Lake Plan Commission and meet the ordinance standards of Clear Lake as administered by the Plan Commission, or its successors. The Town will review and comment on all commercial, industrial, and planned residential projects, and issue a letter of comment to the Plan Commission. The Town will also review the projects for compliance with adopted standards of construction and use of material.

C. The Town of Clear Lake may authorize deviations from these standards and specifications upon written request from a Contractor / Property Owner / Developer.

D. The Developer or Contractor shall submit construction drawings for a plat or development plan to the Town for review and approval prior to any approval by the Plan Commission. Requests for variances shall be submitted in writing to the Town.

E. Details in the construction drawings prepared shall adhere to applicable standards, provisions, restrictions, rules, and conditions set forth in the Standards and Specifications for the Town of Clear Lake.

F. No work may begin until an approved application or executed contract is on file with the Town and all permitting fees have been paid.

1.2 Plan Review

A. All improvements must be reviewed and approved by the Clear Lake Town Council, Plan Commission, and Utility Superintendent or their designated representatives (Town Engineer, Steuben County Surveyor's Office, or any other Town-designated reviewer). Applications and procedures are set forth in these Standards and Specifications.

1.3 **References and Standards**

A. Clear Lake has adopted and is subject to the following ordinances and standards by reference;
   1. Clear Lake Zoning Ordinance
   2. Clear Lake Comprehensive Plan
   3. 327 IAC Article 3 Wastewater Treatment Facilities; Issuance of Permits; Construction and Permit Requirements.
   4. 327 IAC Article 8 Public Water Supply.

B. If there are conflicts between the Clear Lake Wastewater Utility Standards and Specifications and the County ordinances, then the more stringent standards, provisions, restrictions, rules and conditions shall be controlling.

PART 2 - REQUIREMENTS FOR INDIVIDUAL SEWER TAP

2.1 General

A. This Section outlines the submittal requirements and procedures and general design standards for individual sewer tap connections to a Town of Clear Lake (Town) public sewer ("Individual Sewer Tap").

2.2 Application Procedure

A. Application: The owner of the property requesting to be connected, or the Owner's Registered Contractor acting as agent, may prepare and submit the Individual Sewer Tap Permit Application (provided by the Town) and pay the appropriate fees as set out in the Sewer Rate Ordinance.

B. Attachments: The applicant shall attach the following supplemental information to the application:
   1. Copy of Deed.
   2. Detailed Plot Plan showing the proposed location of the sewer tap, the building sewer, grinder pump station (if applicable), all structures (existing or proposed) and the well or water service line.
   3. Easement Document (where applicable) in an approved format for recording.
   4. Application fee of $200 to cover the cost of processing the connection application. Additionally, the cost of the grinder pump, appurtenances, and installation shall be determined by the Town and paid by the applicant.

C. Pressure Sewer Tap & Gravity Sewer Tap Requirements: The applicant shall comply with the Sewer Tap Construction Requirements Specifications (Article 5.7) and applicable details.

D. Grinder Pumps: The applicant shall comply with the Grinder Pump Specifications (Article 5.9) and Details.

E. Easement Requirements:
   1. The minimum width of easements shall be as follows:
      a. Service Lines from grinder pump to main line: 5 feet each side of centerline.
      b. Grinder pump station: 10 feet in diameter from grinder pump center point.
      c. No improvements to be allowed in easements.
   2. Recording of Easements: All easements to contain sewers or service lines to be maintained by Town shall be recorded in one of the following manners:
      a. A recorded Plat with proper dedication noted on the Plat with landowner's notarized signature.
      b. An easement description and easement Plat prepared by and certified by a Registered Land Surveyor and attached as an exhibit to a properly executed and recorded easement document in a form as approved by the Town legal counsel.
      c. The recording of a Development Plan showing necessary easements is not an acceptable form of easement dedication.

PART 3 - REQUIREMENTS FOR SEWER SYSTEM EXTENSIONS & ADDITIONS

3.1 General

A. This Section outlines the submittal requirements and procedures for the extension of the Town of Clear Lake (Town) sewer system. Individual Sewer Taps are not subject to the requirements and procedures of this Part 3 or the following Part 4. This section does include submittal requirements and procedures for sewer systems that are to be turned over to the Town for maintenance ("Extensions") or that are to be connected to the Town sewers, but privately owned and maintained ("Additions").

3.2 Application Procedure

A. Conceptual Plan Approval

1. Application.
   a. The Owner/Developer shall submit a completed Conceptual Plan Application for Extensions or Additions ("Application") (provided by the Town) and "Conceptual Plan Review Checklist" ("Checklist") (provided by the Town).
2. Conceptual Plan Submittal.
   a. Along with the "Application" and "Checklist", submit two (2) copies of a general Sketch Plan of the proposed project and surrounding area. The Sketch Plan should generally including the following:
      1) Boundaries of the proposed development.
      2) Anticipated point of connection to the existing public sewer system.
      3) Proposed easements shown and labeled for sewer utilities.
      4) Intended use.
      5) Site Layout.
      6) Proposed sewer and other utility routes.
      7) The estimated flow to be generated based upon 327 IAC 3-6-11.
      8) No fee is required for the "Conceptual Plan Submittal."
3. Conceptual Plan Review.
   a. The Town Superintendent or his authorized representative shall review the Conceptual Plan Submittal to address capacity requirements and complete the "Conceptual Plan Review Checklist" (provided by the Town).
   b. If the submittal is incomplete, the owner/developer will be notified by letter what is required to complete the application.
   c. If the submittal is complete, the Town Superintendent or his authorized representative shall determine estimated service costs, list concerns and submit to the Town Council for input and approval or denial of the proposed sewer extension.
4. Conceptual Plan Application Approval/Denial.
   a. Based upon the input from the Town Council, the Town Superintendent or his authorized representative will issue a Conceptual Plan Approval/Denial Letter addressing the existing system's ability to handle the proposed flow.
   b. The letter will include the approval or denial of the proposed development and if denied the basis for such denial and, if applicable, a statement as to what can be done to make the proposed development plan adequate for conceptual plan approval.
   c. The letter will contain any special requirements that may be imposed upon the development as a part of any approval.

B. Final Plan Approval

1. General
   a. Upon receipt of "Conceptual Plan Approval," the Developer shall complete a set of development construction plans and specifications in accordance with Indiana State Code and this Town Development Standards, Details and Specification Manual.
2. Application.
   a. The Owner/Developer shall complete a "Final Plan Application for Extensions or Additions" ("Application") (provided by the Town). A copy of the "Conceptual Plan Approval", completed IDEM Permit Application, and completed Waste Allocation Letter shall be attached to the "Application".
3. Final Plan Submittal.
   a. The "Final Plan Review Checklist" ("Checklist") (provided by the Town) shall serve as a guideline for the submittal of the development construction plans for approval and shall be completed by the Design Engineer.
   b. The final plan submittal shall include the following:
      1) "Application"
      2) "Checklist"
      3) Three (3) sets of the plans and specifications.
      4) "Plan Review Fee"
4. Final Plan Review.
   a. The Town Superintendent, his authorized representative, or the Town's Engineer shall review the development construction plans and specifications for compliance with the Town Development Standards, Details, and Specification Manual.
   b. If changes or corrections are required, one (1) copy of the Construction Plan set with required changes/corrections marked or indicated and a letter containing statements or comments regarding additional information or corrections required to obtain approval will be returned to the Owner/Developer's Engineer.
   c. The remaining copies will be retained by the Town to be compared to any changes to plans that are re-submitted.
   d. An additional fee will not be required for the first re-submittal of plans with changes or corrections required by the original comments from the Town's Superintendent or his authorized representative.
   e. If all issues on the plans and specifications have not been properly addressed with the first re-submittal, for each additional submittal review, the Town's cost for each review will be charged to the Owner/Developer.
5. Plan Review Fees.
   a. At the time the Owner/Developer files construction plans for approval, a plan review fee shall be paid in accordance with the following schedule:
      1) Base Fee…… $400.00 (includes up to 10 EDUs)
      2) $25.00 per each additional EDU in excess of 10 units.
6. Notification of Approval.
   a. Upon final approval of the plans and specifications, the Town Superintendent or his authorized representative will issue a letter of approval, along with a "Waste Allocation Letter" for the developer's use in submitting plans to IDEM/ISBOH.
7. Construction Documents.
   a. Three (3) sets of the IDEM/ISBOH approved plans and specifications together with a copy of the IDEM/ISBOH permit/approval shall be provided to the Town, prior to start of construction, for use by the Town for inspection purposes on all projects during construction.
8. As-Built Submittal.
   a. As-Built drawings shall be submitted upon completion of construction and prior to acceptance of system extension or addition by Town Council.

b. Furnish three (3) sets of prints and one (1) electronic file in format compatible with Town software in accordance with Part 3 of this manual.

9. System Acceptance.

a. Upon satisfactory completion of construction and testing, furnishing completed "As-Built" documents, filing the warranty bond, and a deed of dedication, where required, the Town Council shall accept the sewer extension into its system for operation and maintenance, except when the condition of approval requires that the system remain privately owned and maintained.

b. No wastewater shall be discharged into the Town wastewater system until the new system is accepted.

PART 4 - PLAN AND SPECIFICATION REQUIREMENTS FOR SEWER SYSTEM EXTENSIONS & ADDITIONS

4.1 **Design Criteria**

A. General

1. The design criteria for any project to be connected to the Town sewer system shall in all instances be in accordance with the Indiana Administrative Code 327, Article 3 except as modified or made more stringent herein.

B. Flow Calculations:

1. All flows shall be calculated based upon an equivalent residential dwelling unit (EDU) of 220 gpd per unit for pressure sewer systems. Gravity systems for residential dwellings shall use a flow of 310 gpd per dwelling or 1.4 EDUs per dwelling.
2. All other flow calculations shall be based upon Table 11-1 of IAC 327-3-6-11 and converted to EDUs.
3. Peak Flows: Peak flows in conduit will vary with the number of connections and the size of conduit proposed for use. The number of EDU connections to any size main should in general follow the guidelines set out on Table 3.1. A peak flow of not less than 4 times Average Daily Flow (ADF) shall be used in the design of wastewater pump stations.

TABLE 3.1 – PRESSURE SEWER CONNECTION GUIDELINES

This is only to be used as a guideline for preliminary estimating.

NOMINAL PIPE SIZE	DESIGN FLOW @ 2.5 fps	HEADLOSS (C=140) @ 2.5 FPS	RECOMMENDED CONNECTIONS @ 2.5 fps	GPM per CONNECTION	MAXIMUM FLOW @ 7.0 fps	HEADLOSS (C=140) @ 7 FPS	CONNECTIONS @ 7 fps	MINIMUM FLOW @ 2.0 fps	HEADLOSS (C=140) @ 2 FPS
inches	gpm	per 100'	dwellings	flow	gpm	per 100'	dwellings	gpm	per 100'
1.25	9.50	2.42	1	9.5	26.8	16.5	2	7.70	1.64
1.50	14.00	2.04	4	4	38.5	13.3	7	11.00	1.31
2.00	24.50	1.42	18	1.4	68.5	9.5	37	19.70	0.95
2.50	38.00	1.08	32	1.2	107.1	7.3	69	30.80	0.73
3.00	55.00	0.88	55	1	154.2	5.9	118	44.00	0.58
4.00	98.00	0.63	123	0.8	274	4.2	262	79.00	0.42
6.00	220.00	0.39	367	0.6	617	2.64	787	177.00	0.26
8.00	392.00	0.28	980	0.4	1097	1.9	2102	315.00	0.19
10.00	616.00	0.22	1760	0.35	1713	1.5	3742	490.00	0.14
12.00	880.00	0.17	2876	0.306	2468	1.2	5732	710.00	0.12
14.00	1216.00	0.15	3974	0.306	3360	1.0	7804	977.00	0.1
16.00	1566.00	0.13	5118	0.306	4385	0.8	10185	1272.00	0.09

4. Pressure Sewer Design Velocity:
   a. In no case should design velocities drop below 2.0 fps, nor exceed 7.0 fps unless approved as an exception.
   b. All pressure sewer velocity calculations are to be based upon the actual inside diameter of the particular conduit to be used.

5. Pressure Sewer Friction Factor (C):
    a. For PVC and HDPE pressure sewers, a “C” factor of 140 should be used and the “C” factor for ductile iron pipe where approved shall be 120.
6. Gravity Sewer Design Velocity:
    a. Gravity sewer design shall be based upon a minimum velocity of 2.0 fps. Where 8-inch main line gravity sewers are installed and less than 10 EDUs are to be connected, a minimum design velocity of 2.5 fps will be required.
7. Gravity Sewer Pipe Friction Factor (n):
    a. All sewers: n = 0.013

C. Hydraulic Profile Data:
1. All pressure sewer systems shall, as a part of the submittal of construction plans to the Town for approval, have a hydraulic profile based upon the peak design flow and the design pressure at the connection point.
2. Hydraulic Profile on Profile Sheet: The hydraulic profile may be shown graphically by superimposing on the sewer profile sheet. The profile should be noted as “xx” feet above or below datum and show the elevation at all major connection points.
3. Hydraulic Profile in Tabular Form: In lieu of superimposing the hydraulic profile on the profile sheet of the Plan Set, the Design Engineer may provide the elevation of the hydraulic profile in tabular form. The tabular version shall show the elevation at each major connection point and at each 100-foot station.

D. Easement Requirements:
1. On all Extensions or Additions as defined in Part 3 initiated after the adoption of these standards, the minimum width of easements shall be as follows:
    a. Service Lines from grinder pump to main line: 5 feet each side of centerline.
    b. Grinder pump station: 10 feet in diameter from grinder pump center point.
    c. Main line sewers: 20 feet with sewer centerline to be not closer than 5 feet to the edge of easement.
    d. No improvements to be allowed in easements.
2. Recording of Easements: All easements to contain sewers or service lines to be maintained by Town shall be recorded in one of the following manners:
    a. A recorded Plat with proper dedication noted on the Plat with landowner’s notarized signature.
    b. An easement description and easement Plat prepared by and certified by a Registered Land Surveyor and attached as an exhibit to a properly executed easement document in a form as approved by the Town legal counsel.
    c. The recording of a Development Plan showing necessary easements is not an acceptable form of easement dedication.

4.2 **Plan Sets**

A. General:
1. The purpose of this Section is to outline and detail a standardization for the presentation of Construction Plans and Specifications to the Town for review and approval that will minimize the review time by the Town and therefore assure a faster turnaround time for the Owner or Developer.
2. An Indiana Registered Professional Engineer or an Indiana Registered Professional Land Surveyor per State of Indiana requirements shall certify all sheets of any Construction Plan Set, except that any Plat included as a part of the Plan Set must be certified by an Indiana Registered Professional Land Surveyor. All sheets shall be either 24” x 36” sheets or 18” x 24” sheets. The sanitary sewer construction drawings and specifications shall be developed in such manner as to be a “stand alone” Plan Set without construction notes of other utilities, streets, etc.

3. The Final Plan Submittal shall include all sheets of the Construction Plan Set.
4. All plans must be prepared at a suitable scale to properly show all necessary detail.
5. As a minimum, final plan submittal for the sanitary sewer construction Plan Set should include the following elements.

B. All Sheets:
1. Title Block with Project Name and Sheet Description
2. Sheet Numbers – Referenced in Index
3. Engineering Firm's Name, Address and Phone Number
4. Engineer's Name, Signature, and Seal
5. Drawing Date and Revision Date(s)

C. Title Sheet:
1. Developer's Name, Address and Phone Number
2. Owner's Name, Address and Phone Number
3. Location Map (minimum 4 mile square)
4. Sheet Index
5. Utility Contact List
6. Benchmark(s) relative to NGVD 29 or NAVD 88
7. Separate Spec Note (if applicable, see Article 4.2F)

D. Plan and Profile Sheets:
1. Plan Sheet(s):
   a. Scale(s): Vertical scale not greater than 1" = 10'; Horizontal scale not greater than 1" = 50'
   b. North Arrow and Bar Scale
   c. Proposed/Existing Utility Legend(s)
   d. Elevation information relative to Project Benchmark
   e. Plan Layout, Topography, and Contours (Contours at not less than 1 foot for areas of less than 6% slope and 5 foot for areas of 6% or greater)
   f. Street/Road Names
   g. Sewer Centerline Stationing
   h. Stationing and Identification of Bends, Fittings, Branches, Valves and Structures
   i. Sewer Centerline Stationing Tied to Physical Features
   j. Match Lines with Stationing
   k. Existing and/or proposed utilities
   l. Reference Profile Sheets if not a Plan and Profile Sheet
   m. Line Designations and Branch Line Designations
   n. Sewer Flow Direction Arrows
   o. Show any Applicable Flood Plain Data.
2. Profile Sheet(s):
   a. Profiles may be on sheet with plan.
   b. Scale(s): Vertical scale not greater than 1" = 10'; Horizontal scale not greater than 1" = 50'
   c. Stationing to Match Plan Stationing
   d. Match Lines with Stationing
   e. Elevation information relative to Project Benchmark
   f. Existing Grade Above Sewer Centerline
   g. Proposed Grade Above Sewer Centerline, if Different than Existing
   h. Street/Road Crossing Centerline Stationing shown with Name
   i. Existing/Proposed Utility Crossings shown with Stationing and Appropriate Separation
   j. Stationing of Bends, Fittings, Valves, and Structures
   k. Stationing and Line Reference of Branches
   l. Sewer Lengths, Sizes, and Material Type (As Applicable)
   m. 5 Foot Cover Maintained (Where Required)

n. Proposed Elevation of Key Elements of the Profile
o. Hydraulic Grade Line (If not Shown in Tabular Form on Detail Sheet)
p. Flood Plain or Flood Elevation, Where Applicable

E. Detail Sheet(s):
1. Scale(s)
2. Project Specifications (if not provided separately, see Article 4.2F)
a. Referencing Town Standards and Specifications
b. Include Data Required by IDEM/ISBOH
c. Special Conditions
d. Any Special Details Required.
3. Tabular Form of Hydraulic Profile at Key Stations and Branches (If not Shown on Profile Sheets)
4. Pump requirement data per Submersible Pump Stations specifications.
5. Lift Station Specifications (If Applicable)

F. Project Specifications:
1. Project specification may be set out in the Plan Sets or issued in a separate "Specification Document."
2. When separate Specification Documents are provided, a note in ¼ inch high letters shall be added to the Title Sheet as follows: "SPECIFICATIONS FOR THESE PLANS ARE CONTAINED WITHIN A SEPARATE DOCUMENT AND THESE PLANS ARE NOT COMPLETE WITHOUT THE SEPARATE SPECIFICATION DOCUMENT."
3. When specifications are included in the Plan Set, they should be referenced to the Town Development Standards, Details and Specification Manual and supplemented with any special conditions and such information as required for approval from IDEM/ISBOH.
4. "Specification Standards" for Town projects are included in Part 5 of this Manual.

4.3 **As-Built Drawings.**

A. As-Built drawings shall be submitted to Town within sixty (60) days after construction is completed and prior to acceptance of system extension or addition by Town Council. No wastewater shall be discharged into the Town wastewater system until "As-Built" drawings have been accepted/approved by the Town.

B. Certification:
1. As-Built Documents shall be certified to be a true and correct "As-Built Plan" and that all parts of the sewer system, to be maintained by Town, lie within dedicated sanitary sewer easements.

C. Submittal:
1. The prints and electronic file shall include, but not be limited to the following:
a. Property Boundary/Lot Lines with Street Names, Address, Building Line, and Easements OR Plat with Street Names, Lot Numbers, Addresses, Boundary, Lot Lines, Building Lines, and Easements (If Applicable)
b. Elevation information shall be provided relative to Project Benchmark
c. Plan Sheets:
1) Location of Branches, Valves, and Structures Tied to Physical Features
2) Sewer Centerline Tied to Physical Features
3) Line Designations and Branch Line Designations
4) Sewer Flow Direction Arrows
5) Sewer Lengths, Sizes, and Material Type
6) Indicate any Portions Installed by Directional Drilling Method

d. Profile Sheets:
   1) Finished Grade above Sewer Line
   2) Location of Branches, Sewer Taps, Valves, and Structures
   3) Sewer Lengths, Sizes, and Material Type
   4) Indicate any Portions Installed by Directional Drilling Method
   5) Elevations of Key Elements of Profile, including but not limited to:
      a) <u>Gravity Sewer</u>
      b) Invert(s) at Manhole(s)
      c) Top of Casting(s)
      d) <u>Low Pressure Sewer</u>
      e) Invert(s) at Air Release Valve(s)
      f) Top of Casting(s)
      g) Low Point(s) in Line
      h) High Point(s) in Line
      i) Intervals not more than 50 Feet
      j) Information for Pipe Installed by Directional Drilling Method shall be provided at Intervals of not more than 25 Feet
   6) Grade of Gravity and/or Directional Drilled Pipe

PART 5 - SPECIFICATION STANDARDS

5.1 **General**

A. Contractor shall furnish all workmanship and materials for the construction and installation in accordance with the approved development plans and these specifications.

B. Water and Power for Construction Purposes: The Contractor shall furnish all water and power for construction purposes. Any expenses related to temporary water or power connections shall be paid by the Contractor. Connections shall be made in accordance to Local, State, and Federal Codes.

C. Changes caused by Equipment Purchased by the Contractor: The Contractor shall make any and all necessary changes in construction, electrical wiring and piping to install equipment items approved for installation.

D. Testing: All equipment, pipe and appurtenances shall be installed and tested for defects in the manner specified and as approved by the Town.

E. Material Furnished by the Contractor:
   1. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. Installed material discovered to be defective shall be removed and replaced with acceptable material at the Contractor's expense.
   2. The Contractor shall be responsible for the safe storage of material furnished by him or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all equipment, piping and accessories shall be kept free from dirt or foreign matter at all times.

F. Material Furnished by the Town:
   1. The Contractor's responsibility for any material furnished by the Town shall begin at the point of pick up by the Contractor.
   2. The Contractor shall examine all material furnished by the Town at the time and place of pick up and shall reject all defective material. Material furnished by the Town that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor and at the Contractor's expense.

G. Disposition of Defective Material: All material found during the progress of the work to have cracks, flaws or other defects will be rejected by the Town's authorized inspector. The Contractor shall promptly remove all defective materials from the site of the work.

H. Disposal of Waste and Water: During and after the progress of the work, the Contractor shall dispose of all soil, water and debris in a manner to meet Federal, State, and Local Codes.

I. Permits: All permits for construction shall be secured and paid for by the Owner/Developer.

J. Construction: It is the expressed intent of these specifications, that the project be complete with minimum interference to the operation of the existing wastewater system.

K. Watermain Crossing: Where sanitary sewer and water main cross, one full 20 foot length of water main should be centered over the sanitary sewer, and the vertical distance to be a minimum of 18 inches. Where water lines and sewers cross and the minimum clearance cannot be maintained, the sewer must be constructed of water main grade ductile iron pipe with mechanical joints or ASTM D2241-96b, Standard Specifications for Polyvinyl Chloride (PVC) Pressure Rated Pipe and having a SDR ratio of 21 with compression joints within ten feet of the water line.

L. Field Inspection:
1. Notify the Town at least forty-eight (48) hours prior to start of construction. Notification shall be made to an individual in Town's main office during normal business hours. The contractor shall also review the materials list with the Town Superintendent or his authorized representative prior to beginning work. Copies of the contractor's construction documents shall be made available to the Town Superintendent or his authorized representative.
2. The pipe and bedding shall be inspected by Town prior to backfilling of the trench.

M. Inspection Fees: The Owner/Developer will be responsible to compensate Town for inspection provided by Town. Additional compensation will be required for any inspection considered "overtime". "Overtime" includes but is not limited to, working before or after Town's normal operation hours, holidays, or weekends.

N. Notification by Contractor Prior to Construction: Contractor shall give 48 hour notice to all utility companies whose utilities may be affected by the work.

O. Shop Drawings:
1. Provide the Town with six (6) copies of the shop drawings for all components of the proposed system prior to construction, as set out in these specifications. Shop drawings shall be approved by the Design Engineer prior to submitting to the Town.
2. Should the contractor fail to provide shop drawings prior to construction, the system will not be accepted by the Town and no wastewater from the system will be accepted.

P. Equipment Manuals:
1. The Contractor shall furnish three (3) sets of equipment manufacturer's operation and maintenance materials and manuals for the use in preparation of the Operation and Maintenance Manual. The O & M Manual must include the manufacturer's manuals and sources of service and parts in compliance with Environmental Protection Agency requirements.
2. The material furnished under this sub-section shall not necessarily be considered a part of the Shop Drawing requirements as set in the General Conditions.
3. A printed operation and maintenance manual shall be provided for every mechanical and electrical equipment item and shall be legible and bound in a soft cover. The manuals shall be furnished to the Engineer prior to the time at which construction is 50% complete.

Q. Manufacturer's Service Representative: The Contractor shall provide the services of qualified and technically trained representative(s) of the manufacturer(s) of the principal items of equipment, as necessary to supervise the installation of the equipment, supervise the start-up, and instruct the operation personnel in the operation and maintenance of the equipment. These services shall be provided as part of the work under the applicable contract items and no extra payment will be made by the Town for any such services in connection with the installation, start-up, operation, and maintenance instructions relating to the equipment.

R. Adjustment and Operation of Systems:
1. Prior to time of final inspection, the Contractor shall carefully adjust and place in operation all parts of the equipment, systems and electrical facilities, installed by him when any work included in this contract is completed. The Contractor shall also assist in the adjustment of equipment and

systems furnished by the Owner and installed by the Contractor. All automatic controls and safety devices shall be adjusted, all air and water flow shall be balanced and adjusted, and all valves shall be properly set. The Contractor shall perform all other necessary operations to make the equipment, systems and electrical facilities fully operable. Where required, all equipment shall be oiled and greased and all oilers and grease cups shall be left filled.

2. Upon completion of this work, the Contractor shall notify the Engineer that all equipment, systems and electrical facilities are ready for final tests and inspection and shall cooperate with the Owner's representative in charge in conducting the tests and inspection.
3. At the time of final inspection, the Contractor shall be represented by a person of authority. Major subcontractors also shall be represented. Each shall demonstrate that his work fully complies with the purpose and intent of the plans and specifications. All labor, all services, and all instruments or tools necessary for such demonstration and tests shall be provided by the Contractor.

S. Traffic Control:
1. Traffic Control shall be in accordance with the Indiana State Department of Transportation Specifications (latest edition), Section 800 and OSHA regulations.
2. Full Lane Closures
    a. No full lane closures will be allowed on State Roads.
    b. The Contractor may, with the approval of the authority having jurisdiction, close local roads for minimum periods of time with proper notice to the Town or County Highway Department as applicable, local occupants of all premises, police and fire protection authorities, and other public authorities as applicable. The Contractor shall schedule this work so that this time is at a minimum and shall, whenever possible, make suitable provisions for access by local residents, businesses, school buses, police and fire emergency vehicles and mail delivery vehicles. The Contractor shall keep fire hydrants and other public utility valves accessible at all times.
    c. The Contractor shall submit traffic control plans to the Town or the County Highway Department if required.
    d. The Contractor shall furnish, erect, and maintain barricades, suitable and sufficient red lights and other lights or reflecting material as may be required for the protection of any local traffic permitted on the roadway.
    e. The Contractor shall furnish, erect, and maintain advanced warning signs to direct traffic away from closed sections and detour marking signs on temporary routes, except where same may be furnished by the State or County Highway Departments.
    f. All road crossings where the Contractor is permitted to open cut the trench, the crossing shall be completed, cleaned up, temporary pavement in place, and open to traffic within twenty-four (24) hours from the time the road is closed to through traffic, unless specific approval is received from the authority having jurisdiction, for a longer period.
3. Single Lane Closures
    a. No single lane closures will be allowed on State Roads.
    b. The Contractor may, with the approval of the authority having jurisdiction, close a single lane on local roads. The Contractor shall submit traffic control plans to the Town or the County Highway Department for review and approval.
    c. The Contractor shall furnish, erect, and maintain lights, signs, barricades, temporary guardrails and other traffic control devises, watchmen and flagmen as may be necessary to maintain safe traffic conditions.
    d. Whenever it is necessary to divert traffic from its normal channel into another channel, such diversion shall be clearly marked by cones, drums, barricades or temporary guardrail. If markers are left in place at night, pot flares or other suitable lights shall be maintained.

5.2 **Excavations and Backfill**

A. Excavation:

1. All earth excavation for gravity sewers shall be open cut from the surface, except where otherwise shown on the drawings. Excavation shall be interpreted to mean: clearing the site; pavement removal where required; excavation of the material encountered to the proposed grade of the pipe bedding; furnishing and placing all sheeting, trenching, trimming and bracing; supporting of structures above and below ground; removal and disposal of water; repairing damage to structures, conduits, and utilities encountered; backfilling; compacting; temporary surfacing of roadways; disposal of surplus materials; providing barricades and lighting; and restoration of the site. During the progress of excavation, care shall be exercised to reserve sufficient material for backfilling above the embedment material.
2. Where the directional boring method of construction is to be used, all bore pits, connection pits and service line connection pits shall be excavated and backfilled in the same manner as open cut excavation.

B. Excavation to Grade:

1. In areas of existing utilities and drains the Contractor shall proceed with caution in the open-cut excavation and preparation of the trench so that the exact location of underground structures and utilities, both known and unknown, may be determined, and Contractor shall be held responsible for the repair of such when broken or otherwise damaged. The trench shall be excavated to a point four inches (4") below the bottom of the pipe and backfilled with approved bedding material so as to provide a uniform and continuous bearing on the lower 90 degrees of the pipe between bell holes.
2. Any part of the bottom of the trench excavation below the specified grade shall be backfilled and compacted to design grade with compacted sand or #53 or #73 aggregate or #12 gravel (pea gravel) material. Bell holes shall be provided at each joint to permit joints to be made properly.
3. Open trenches shall be properly protected and guarded by the Contractor in such a manner as to prevent accidents, casualties, or damage of any nature whatsoever to persons, vehicles and abutting property. Open trenches left overnight or periods of time longer than 6 hours shall be protected by properly supported "Safety Fence".
4. The trench shall be excavated so that the pipe can be laid to the alignment and grade required. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. Discharge from any trench dewatering pumps shall not be into a new or existing sanitary sewer system. Discharge from trench dewatering pumps shall be in a manner to meet Federal, State, or Local Codes. Flows from trench dewatering pumps shall pass through an approved sediment removal system prior to discharge.
5. When installing pressure sewers by directional boring, all bore pits and pits for connecting pipe shall be treated in the same manner as open trench excavation.
6. The Contractor shall thoroughly familiarize himself with OSHA rules and regulations relating to the Construction Industry, with specific attention being given to the section devoted to open trench construction.

C. Exploratory Excavation:

1. Location of Existing Underground Facilities:
    a. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.
    b. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

2. The Contractor will be required to excavate and locate existing underground improvements in advance of proceeding with both open-cut excavation and directional boring for the conduit or, in the case of open-cut, carry the excavation sufficiently in advance of pipe laying operations that changes in line and grade may be accommodated in order to avoid such existing underground improvements.
3. Various underground conduits and other structures may be shown on the drawings, as taken from the records of the respective utilities, but other structures and field tile not shown on the drawings may be encountered. The Contractor shall be held responsible for the repair of all improvements broken or otherwise damaged, including reconnection of field tile.
4. On the basis of the information obtained from the exploratory excavation, the Owner's Engineer may order certain changes in line or grade of the conduit. In any case, changes in the new conduit, or in existing improvements, shall be made only with the concurrence from the Town.

D. Pipe Clearance in Rock:
1. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six inches (6") below and on each side of all pipe and appurtenances. Pipe bedding shall be utilized around the pipe within these clearance areas.
2. The specified minimum clearances are the minimum clearance distances which will be permitted between any part of the pipe and appurtenances being laid, and any part, projection or point of such rock, boulder or stone.

E. Pipe Trench Preparation
1. No more than 100 feet of trench may be opened in advance of pipe laying. Trenches in rock shall be fully opened at least 30 feet in advance of where pipe is being laid.
2. The width of trench shall be the minimum which will permit the pipe to be laid safely and jointed properly and the backfill to be placed and compacted as specified and as recommended by the pipe manufacturer and the Town / Engineer.
3. Trench width shall be minimized to the greatest extent practical, but shall conform to the following:
    a. Sufficient to provide room for installing, jointing and inspecting piping.
    b. Sufficient for shoring and bracing, or shielding and dewatering.
    c. Sufficient to allow thorough compaction of backfill adjacent to bottom half of pipe.
    d. Widths as recommended by the pipe manufacturer.
4. Where the existing material beneath the bedding material is considered unsuitable by Engineer, Contractor shall remove and replace it with backfill or fill material as approved by Engineer.
5. Depth of trench shall be as shown. If required and approved by Engineer, in writing, depths may be revised.

F. Sheeting, Bracing and Shoring:
1. Where required to properly protect the construction work, adjacent property, work or workmen, sheeting, bracing and shoring shall be provided. If the Owner's Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports, but neither the placing of such additional supports by the order of the Owner's Engineer nor the failure of the Owner's Engineer to order such additional supports placed, shall release the Contractor from his responsibility for the sufficiency of such supports for protection of the work and adjacent property work or workmen until the excavation has been backfilled and compacted.
2. Sheeting Left in Place: Sheeting, bracing and shoring shall not be left in place after completion of the work except as required by written order of the Owner's Engineer. Where required to protect the work, adjacent structures or property, sheeting, bracing and shoring shall be left in place, but shall be cut off and left not less than two feet (2') below the established surface grade.

G. Removal of Water: The Contractor shall provide and maintain during construction, adequate equipment to properly remove and dispose of all water entering the trench or other part of the work where conduits are being placed. In water bearing strata, well points or underdrain material may be required to affect a dry trench or pit. No pipe shall be laid in water or when, in the opinion of the Owner's Engineer or the Town's authorized inspector, trench conditions are unsuitable.

H. Piling of Excavated Material: In general, material excavated from trenches will not be allowed to be piled on adjacent walks and driveways. The amount of Public Street which may be occupied by the construction work at any time shall be subject to the requirements of the use of the street by the public and approval by the Town. Piling of material outside of right-of-way or easement lines will not be allowed.

I. Disposal of Excavated Materials: All suitable excavated material shall be used in backfilling over the pipe and appurtenances or distributed otherwise by the Contractor. All excavated material in excess of the quantity required for backfilling and subsequent settlement shall be disposed of in a timely and appropriate manner. The Contractor shall be responsible for securing disposal site(s), grading, seeding and erosion control, etc.

J. Blasting: Blasting and explosives will not be permitted.

K. Pipe Bedding:
   1. Bed pipe as specified herein and in accordance with the Town standard drawings.
   2. Excavate trenches below bottom of pipe by amount shown and indicated in the Town standard drawings and permitted Contract Documents. Remove loose and unsuitable material from bottom of trench.
   3. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
   4. Bedding to be shaped to provide continuous bearing support to pipe for full length. Bedding to be shaped to receive bell and maintain bearing support on remainder of pipe.
   5. Do not lay pipe until Town / Engineer approves bedding condition.
   6. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

L. Backfilling:
   1. All open-cut trenches and excavations shall be backfilled from the top of the embedment material to at least the original surface of the ground or pavement subgrade with allowances made for subsequent settlement. Backfill material shall be deposited in the trench for its full width simultaneously.
   2. For non-pavement areas the backfill shall be placed in 8-inch loose layers and lightly compacted to the original grade level. For pavement areas, the backfill shall be placed in 8-inch loose/6-inch compacted layers and compacted as per specifications. In placing the backfill, the Contractor shall exercise care so as to avoid moving or damaging the new pipe, appurtenances or existing utilities.
   3. Backfilling shall not be completed in freezing weather except by permission of the Town's authorized inspector. No backfilling shall be made with frozen material, nor shall backfilling be made when the material in the trench is already frozen.

M. Standard Backfill Material:
   1. Backfill material for non-pavement areas shall be the material removed from the trench, if suitable. Backfill shall be shall be stockpiled native sandy clay or granular soils obtained from on-site excavations and which are uniformly mixed, contain no organic matter, nor contain rocks or fragments greater than 3 inches in size, nor have greater than 40 percent passing the 200 sieve.

2. Standard backfill and fill materials from off-site sources shall consist of silty or clayey sand soils that are uniformly mixed, contain no organic matter and which have a Plasticity Index less than ten. The maximum particle size of imported soils shall be 3-inches or less, if required to satisfy trenching, landscaping, or other requirements. The moisture content of the backfill and fill materials shall be within two percent (2%) of optimum per ASTM D1557.
3. All materials for use as backfill and fill material shall be tested by the laboratory services, as requested by the Town / Engineer. If on-site material is unsuitable, as determined by the Town / Engineer, Special Backfill or approved off-site fill shall be used.
4. Excavated material reserved for backfill material shall be placed in a manner that will not disturb the pipe.

N. Special Backfill

1. Special Backfill for use beneath structures, concrete slabs and asphalt pavements (and where shown or specified below and around structures) shall be in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Section 904. The material shall be acceptable quality, free from large or frozen lumps, wood, or other extraneous matter. Backfill shall be in accordance with gradation for No. 53 or No. 73 coarse aggregate in accordance with the gradation requirements of INDOT Standard Specifications latest edition, Section 904.03(e).

O. Compaction:

1. Compaction will be required of all embedment material. The Contractor shall maintain on the job site with each crew, a copy of the manufacturer's recommendations with respect to pipe embedment material and compaction.
2. With respect to special backfill material, the Contractor shall place the material in lifts and compact each lift per the following table.
3. Material shall be within plus or minus two percent (2%) of optimum moisture content. The Contractor shall submit to the Town written documentation of proof of compaction. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Town / Engineer. Jetting, flooding, puddling, or vibroflotation may not be used without written consent of the Town / Engineer. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated. Granular bedding for structures shall have each lift thoroughly compacted and seated with the subgrade. Compaction methods and procedures shall be subject to approval of the Town / Engineer. Unless otherwise indicated or approved by the Town / Engineer, place fills in the loose lift thicknesses indicated hereafter and compact to a dry density not less than the specified percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D1557, unless otherwise noted.

Usage	Percent Compaction	Lift Thickness
Subgrade and Subbase Fill:		
Below Pavements, Walkways	95	8
Below Footings or Structural Slabs	98	6
Lawn Areas	90	8
Fill Adjacent to (Or Behind) Vertical Walls	95	8
Special Backfill (Pipes & Structures)	95	6
Trench Backfill Above Pipe (Lawn Areas)	90	8
Manhole / Drainage Structure Backfill (Lawn Areas)	90	8
Granular Pipe Embedment Material	90	6

4. The Contractor shall submit to the Town in writing a detailed plan for achieving adequate compaction prior to commencing construction.

5. In all areas of special backfill and in other areas at the discretion of the Town, the Contractor shall provide an outside consulting firm to provide the testing. Testing shall be in accordance with INDOT specifications for testing. The consulting firm providing the testing shall provide a copy of the results to the Town for verification of the compaction.

P. Compaction Testing During Construction
   1. Quality Control Testing During Construction: Contractor's independent testing service shall inspect and approve subgrades and fill layers before construction Work is performed thereon. All associated costs for density testing as specified by the Town shall be at the expense of the Contractor.
   2. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
   3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   4. Tests of subgrades and fill layers shall be taken as follows:
      a. The frequency of Contractor confirmation tests shall be not less than as follows: Each test location for trenches shall include tests for each layer, type, or class of backfill from bedding to finish grade.
         1) Trenches for Underground Facilities:
            a) In open fields: Two locations every 1,000 linear feet.
            b) Along dirt or gravel roads or off traveled Right-of-Way: Two locations every 500 linear feet.
            c) Crossing paved roads: Two locations along each crossing.
            d) Under pavement cuts or within two feet of pavement edges: One location every 400 linear feet.
         2) For Structural Backfill: On 30-foot intervals on all sides of the structure for every compacted lift, but no less than one per lift on each side of the structure for structures less than 60 feet long on a side.
         3) In Embankment or Fill: One per 1,000 square feet on every compacted lift.
         4) Base Material: One per 1,000 square feet on every compacted lift.
         5) Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least 1 test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Town / Engineer.
      b. Copies of the test reports shall be submitted promptly to the Town / Engineer. Contractor tests shall be performed by a soils testing laboratory acceptable to the Town / Engineer.

Q. Construction in Highway Rights of Way: All construction within the road rights of way is to be carried out in complete accordance with the requirements of the respective highway authority: Town, County, or INDOT.

R. Special Construction: It is anticipated that special construction procedures may be required or acceptable at certain locations when shown on the drawings or otherwise approved. Where required or approved, special construction procedures shall consist of jacking, boring, or tunneling a casing pipe for installation of the carrier pipe, pipe bursting or directional boring of either casing pipe or the carrier pipe. When required casing pipe lengths, sizes, thickness and location will be shown on the drawings.

S. Directional Boring:
   1. When the directional bore method of construction is required, specified, or allowed for the installation of HDPE pipe or other, the directional bore shall be made using equipment of adequate size and capacity and as approved by the pipe manufacturer. All excavation for boring or connecting pits shall be backfilled in accordance with the specifications for open cut.

2. The directional drilling operation shall be a minimum of a two-stage process. The first stage shall consist of drilling a pilot hole formed by the use of a drill bit. During this drilling process, bentonite or equal drilling fluid shall be pumped down the center of the drilling rods with a separate pipe used to remove the soil cuttings that have become mixed with the drilling fluid liquid. The second stage of the directional drilling operation shall consist of reaming out the pilot hole to accommodate the pipeline. All reaming devices shall be attached to a pipe that removes the soil cuttings and conveys them to the surface.
3. The pilot hole and reamed hole shall be drilled so as to provide straight sections and uniform transitions from straight to long radius curve sections. The pipeline profile shall contain no high points except as noted on the drawings. The drill path shall be monitored by using a pothole machine and electronic package. The minimum required cover force mains shall be five (5) feet. At no time shall any bore contain voids. All directional drilling shall be stopped immediately if any surface deformation is detected in the road right-of-way.
4. No additional payment will be made for failed drilling attempts.
5. All utilities along bore path shall be vacuum excavated to determine exact location and elevation prior to construction.

T. Site Clearing:
1. Prior to performing open cut from the surface, the area shall be cleared of trees, timber, stumps, brush, fences, rubbish, and other obstructions, except such items as may be indicated or directed to remain. Trees to remain shall be protected as set forth in the Erosion Control Plan Submittal. Only those trees, brush, fences, lawns, sidewalks, pavement, and driveways that fall within the earth excavation shall be removed.
2. Clearing of trees shall be performed in a manner as to protect trees to remain, existing structures, proposed structures, and employees and others.
3. The Contractor shall remove, salvage, and keep separate all topsoil, and carefully replace topsoil after backfilling is complete.
    a. Disposal: The Contractor shall dispose of all trees, timber, stumps, brush, fences, rubbish, and other obstructions resulting from clearing and grubbing. All items disposed shall be in accordance with State, Local, and Federal rules and regulations. All liability resulting in the disposal of items due to clearing and grubbing shall become the responsibility of the Contractor.
    b. Grubbing: Grubbing shall consist of the removal and disposal of stumps, roots larger than 1/2 inches in diameter, and matted roots. This material, together with logs and other organic and metallic debris not suitable for foundation or subgrade purposes, shall be excavated and removed to a depth of not less than 18 inches in depth below the original ground level in embankment areas and not less than 2 feet below the finished ground level in excavated areas. Depressions made by grubbing shall be filled with suitable material and compacted as set forth in these specifications.
    c. Protection of Trees & Shrubs:
        1) The Contractor shall NOT damage or destroy any existing trees or shrubs located in street Rights-of-Way and easements. Trees shall be protected as set forth in the Erosion Control Plan Submittal.
        2) Where limbs or branches of trees or shrubs conflict with construction operations, the Contractor shall protect trees by tying limbs or branches back whenever possible. Limbs and branches may be pruned when tying limbs or branches cannot be accomplished. The trees shall be pruned according to Natural Target Pruning standards by a certified arborist. Dead branches of 1-1/2 inches in diameter may be trimmed. If construction operations require that trees or bushes be removed, the Contractor shall be wholly responsible for satisfying all claims for restoration or restitution resulting from the damage or removal of trees or bushes.

3) Small trees and shrubs that may be relocated or pruned to permit more working space during construction operations, shall be done in accordance with Home and Garden Bulletin No. 83, Department of Agriculture, “Pruning Shade Trees and Repairing Their Injuries.” The Contractor shall obtain written permission from property owners to move or prune existing trees or shrubs on their property.

4) Trees and shrubs damaged by the Contractor shall be repaired in accordance with said Bulletin No. 83.

d. Remove and Replace Fence: Where existing fences are to be removed the existing fence shall be removed neatly and stored carefully. The existing fence materials shall be reused, provided the materials were not damaged during removal. Any damaged materials shall be replaced with new material of equal quality and match in appearance to the existing material. Reinstallation of the fence shall match the line and height of the existing fence, except as directed by the Engineer, when fences are to be replaced. Fences that are required for security of private, commercial, or public property shall be reinstalled before the end of the workday in which they were removed.

e. Remove and Replace Mail Boxes: Where existing mailboxes are removed, they shall be removed neatly and stored carefully or installed in a temporary location as directed by the Engineer. Reinstallation of mailboxes shall match their previous location and height. The existing materials shall be reused, provided the materials were not damaged during removal. Any damaged materials shall be replaced with new material of equal quality and match in appearance to the existing material.

f. Remove and Replace Groundcovers: Groundcovers that are to be retained shall be preserved and protected. Items that must be disturbed or relocated shall be carefully removed so as to prevent damage to the root systems, stored, and replanted as soon as possible after construction in the area is completed. Heeling in, mulching and regular watering are minimum preservation treatments.

g. Remove and Replace Signs: Where existing signs are removed, they shall be removed neatly and stored carefully or installed in a temporary location as directed by the Engineer. Reinstallation of signs shall match their previous location and height. The existing materials shall be reused, provided the materials were not damaged during removal. Any damaged materials shall be replaced with new material of equal quality and match in appearance to the existing material.

5.3 **Site Restoration**

A. Temporary Surfacing: The Contractor shall provide all temporary roadway surfacing and maintenance of the temporary surfacing until the backfill has been properly compacted and prepared, to permit pavement replacement. Temporary roadway surfacing over the entire area of surface where the pavement has been removed shall consist of not less than a twelve inch (12") depth of compacted #53 or #73 coarse aggregate in accordance with the gradation requirements of INDOT Standard Specifications, latest edition, Section 904.03(e), or a two inch (2”) layer of cold mix asphalt as may be approved by the Town. The Contractor shall provide an emergency contact telephone number in case of settlement or failure.

B. Site Restoration: The Contractor shall restore all sidewalks, property monumentation, curbing, gutters, drives, fences, poles, top soil, grass, trees, landscaping, or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, unless noted otherwise. A registered professional surveyor shall replace property stakes when removed or disturbed.

C. Roadway Pavement:

1. All materials for pavement replacement shall conform to the applicable requirements of the Indiana Department of Transportation (INDOT) Standards and Specifications, latest revision thereto unless otherwise specified.
2. No permanent roadway pavement shall be replaced until the condition of the backfill is such as to properly support the pavement. Types of pavement indicated on the drawings refer to the wearing surface only except as may be otherwise indicated.
3. The edges of the existing pavement shall be sawed, cut with a wheel or other approved manner in a neat and straight line along the edges of the backfilled trench before placement of any permanent pavement replacement.
4. In the preparation of the subgrade for pavement replacement, the temporary surfacing shall be removed to the subgrade of the pavement replacement and any loose or cracked pavement adjacent shall be cut and removed. The subgrade shall be accurately graded and compacted. Where the subgrade under the undisturbed pavement has fallen away, the Contractor shall provide properly compacted material or flowable fill under the pavement or remove such pavement as may be necessary to provide a firm supporting pavement subgrade foundation.
5. Subgrade for Base
    a. The Contractor shall prepare the subgrade for the new pavement base material by fine grading, rolling and compacting to the lines and grades as set out in the Contract Drawings. All sub-grades shall be compacted per the Excavation & Backfill portion of these specifications.
    b. Prior to placement of aggregate base for roadways, subgrade shall be proof-rolled with a tri-axle dump truck loaded with twenty (20) tons and approved by the Town / Engineer. There shall be one or two complete coverages as directed by the Town / Engineer. Tire tracks, irregularities, or failures shall be corrected at the Contractor's expense. Proof-roll shall be within twenty-four (24) hours of base placement / paving operations.
6. Pavement Thicknesses: All pavement thickness as specified shall be finished thickness.
7. Stone Base
    a. When stone base is specified, it shall be constructed to the line, grade, cross section and depth as indicated on the Drawings.
    b. Stone Base shall consist of aggregate, placed and compacted in layers not less than three inches (3") in depth and not exceeding six inches (6") in depth, to the full depth specified.
    c. Place and compact as shown on plans and details.
    d. The aggregate material shall be placed in a manner to prevent segregation of the material.
    e. The material shall be well compacted by approved mechanical means. Jumping jacks, plate compactors, and backhoe compactors may be used in small areas as determined by the Town. Rollers shall be used in larger areas.
    f. Stone base shall be proof-rolled with a tri-axle dump truck loaded with 20 tons and approved by the Town / Engineer. There shall be one or two complete coverages as directed by the Town / Engineer. Tire tracks, irregularities, or failures shall be corrected.

D. Asphalt Pavement

1. Asphalt Pavement Replacement:
    a. Replacement of existing pavement using an asphalt cross section shall be in accordance with permit requirement but shall consist of no less than the following.
    b. Residential / Local Pavement:
        1) Ten-inch (10") depth #53 aggregate compacted in two layers of equal depth.
        2) Three inch (3") depth of HMA 19mm Intermediate Type B
        3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.
    c. Collector / Light Industrial Pavement:
        1) Fourteen-inch (14") depth #53 aggregate compacted in two layers of equal depth.
        2) Three inch (3") depth of HMA 19mm Intermediate Type B

3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.

d. Arterial / Heavy Industrial Pavement:
   1) Sixteen-inch (16") depth #53 aggregate compacted in three layers of equal depth.
   2) Four and one half inch (4-1/2") depth of HMA 19mm Intermediate Type B
   3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.

e. Where the existing cross section of any road is greater, the greater section shall be used.

2. Hot Mix Asphalt (HMA) Paving
   a. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements in accordance with the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Section 402.
   b. Quality Assurance
      1) Manufacturer Qualifications: Manufacturer shall be an INDOT certified hot mix asphalt producer and shall be listed on the most recent version of the INDOT list of certified hot mix asphalt producers, unless otherwise approved by the Town.
      2) Laboratory Qualifications: Testing laboratory shall be an INDOT certified hot mix asphalt laboratory and shall be listed on the most recent version of the INDOT list of certified hot mix asphalt laboratories, unless otherwise approved by the Town.
      3) Regulatory Requirements: Comply with INDOT Standard Specifications latest edition, Section 402 and provisions thereto for asphalt paving work.
   c. Environmental Limitations
      1) Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
         a) Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
         b) Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
         c) Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
      2) Pavement Marking Paint: Apply on a clean, dry surface, only when the following conditions are met:
         a) Do not place pavement markings unless the surface temperature is between 50 deg F and 95 deg F.
   d. Products
      1) Aggregates
         a) General: All aggregates used in asphalt mixture shall be in accordance with INDOT Standard Specifications latest edition, Section 904. Use materials and gradations that have performed satisfactorily in previous installations.
         b) Coarse Aggregate: ASTM D 692, hard, strong; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
         c) Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
         d) Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.
      2) Asphalt Materials
         a) All Hot Mix Asphalt (HMA) material shall conform to applicable requirements of the INDOT Standard Specification latest edition, Sections 402 and 406. All bituminous mixtures shall be as follows: HMA Surface, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B). HMA Intermediate, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B). HMA Base, Mainline, Crushed limestone or slag and with a minimum design ESAL of 2,000,000 (Type B).

b) Tack Coat: Rapid-curve liquid asphalt conforming to INDOT Standard Specification latest edition, Section 406. Water: Potable. Recycled materials (RAP): Per INDOT Standard Specifications latest edition, Section 402.08 for Recycled Materials, not to exceed 25% by weight (mass) of the total mixture.

3) Auxiliary Materials
   a) Fine Aggregates: Per INDOT Standard Specifications latest edition, Section 904.
   b) Pavement-Marking Paint: All pavement marking materials shall be in accordance with INDOT Standard Specifications latest edition, Section 808. Color: White and Yellow

4) Mixes
   a) Hot-Mix Asphalt (HMA): Provide dense, hot-laid, hot-mix asphalt plant mixes with the following requirements. Provide mixes with a history of satisfactory performance in geographical area where Project is located. Surface Course: 110#/in/syd HMA Surface, Type B. Base Course: 110#/in/syd HMA Intermediate, Type B. Subbase: INDOT #53/#73 Compacted Aggregate over INDOT #2 Compacted Aggregate, layer thickness as shown in the Drawings.

e. Line and Grade
   1) Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
   2) Where indicated on Drawings, finish surface grades to match existing. Contractor responsible to implement adequate grade control.
   3) Shoulders: Construct to line, grade, and cross-section shown.

f. Subbase
   1) The construction of the subbase shall conform to the details shown on the plans.

g. Preparation
   1) Prepare subgrade as specified in INDOT Standard Specifications latest edition, Sec. 402.11.
   2) Existing Roadway:
      a) Modify profile by grinding, milling, or overlay methods as approved, to provide transition to existing adjacent pavement and surfaces and to produce smooth riding connection to existing facility. Where pavement overlay is proposed or required, all butt joints shall be milled to the depth of the proposed overlay and shall include a minimum 20 foot long milled transition area.
      b) Sawcut existing roadway to create clean edge.
      c) Paint edges of existing adjacent pavement with tack coat prior to placing new pavement. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.
      d) Preparation of Surfacing: The Contractor shall adjust all manholes, valves, catch basins, inlets, etc. to finish grade. Contractor may make such adjustments by using an approved adjustment ring.

h. Examination
   1) Verify that subgrade is dry and in suitable condition to support paving & imposed loads.

2) Prior to placement of the pavement, proof-rolling of the sub-base shall be required as evidence that the sub-base is in a firm and unyielding condition and completed with a uniform density. Complete proof-rolling operations per the requirements of these Specifications. All soft and yielding material that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. Paving material shall not be placed on a soft, spongy, frozen or otherwise unsuitable subgrade, sub-base or base. Proof-roll shall be within twenty-four (24) hours of base placement / paving operations.

3) Proceed with paving only after unsatisfactory conditions have been corrected.

i. Surface Preparation

1) General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

a) Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

2) Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.00251 Ton/Syd (0.06 gal/Syd) per INDOT Design Manual latest edition, Chapter 17 – Quantity Estimating.

a) Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

b) Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3) Equipment: The tack coat material shall be applied with a pressure distributor similar to that required by the Indiana Department of Transportation Specifications, latest edition, and shall be equipped with hose and nozzle for hand spray operation.

j. Patching

1) Hot-Mix Asphalt (HMA) Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

2) Portland Cement Concrete (PCCP) Pavement: Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

3) Tack Coat: Apply per Surface Preparation requirements of this Specification.

4) Patching HMA: Partially fill excavated pavements with HMA base mix and, while still hot, compact to line and grade appropriate for placement of surface. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

k. Hauling: Hot asphaltic concrete shall be laid hot. When hauling, hot asphaltic concrete trucks shall be required to cover the materials with tarps at all times and take other precautions to assure the proper temperature of the mix. Any material which falls below the temperature requirements of the mix, as set out in the Indiana Department of Transportation Specifications shall not be used in the work.

l. Placement

1) Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

a) Place hot-mix asphalt surface course in single lift.

b) Spread mix at minimum temperature of 250 deg F (121 deg C).
c) Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
d) Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

2) Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
a) After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

3) Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

m. Joints

1) Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
a) Clean contact surfaces and apply tack coat to joints.
b) Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
c) Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
d) Construct transverse joints as described in INDOT Standard Specifications latest edition, Section 402.14.
e) Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
f) Compact asphalt at joints to a density within 2 percent of specified course density.

n. Compaction

1) General: Compaction shall conform to INDOT Standard Specifications latest edition, Section 402.15 for the minimum number of rollers and coverage. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
a) Complete compaction before mix temperature cools to 185 deg F (85 deg C).

2) Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

3) Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted.

4) Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still at the highest temperature where the mixture does not exhibit any possibility for distortions.

5) Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

6) Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

7) Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
8) Erect barricades to protect paving from traffic until mixture has cooled sufficiently to prevent distortions.

o. Installation Tolerances
1) Thickness: Compact each course to produce the thickness indicated within the following tolerances:
a) Base Course: Plus or minus 1/2 inch (13 mm).
b) Surface Course: Plus 1/4 inch (6 mm), no minus.
2) Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
a) Base Course: 1/4 inch (6 mm).
b) Surface Course: 1/8 inch (3 mm)
c) Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

p. Pavement Overlay
1) Preparation:
a) Remove fatty asphalt, grease drippings, dust, and other deleterious matter.
b) Surface Depressions: Fill with asphalt concrete mix, and thoroughly compact.
c) Damaged Areas: Remove broken or deteriorated asphalt concrete and patch as specified.
d) Portland Cement Concrete Joints: Remove joint filler to minimum ½ inch (12 millimeters) below surface
2) Application:
a) Tack Coat: As specified in this section.
b) Place and compact asphalt concrete as specified.
c) Place first layer to include widening of pavement and leveling of irregularities in surface of existing pavement.
d) When leveling irregular surfaces and raising low areas, the actual compacted thickness of any one lift shall not exceed 2 inches (50 millimeters).
e) Final wearing layer shall be of uniform thickness, and meet grade and cross-section as shown.

q. Field Quality Control
1) Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
a) Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
2) Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
3) Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to INDOT Standard Specifications latest edition, Sections 402.13 and 402.15.
4) Testing Requirements and Frequency
a) Quality Control Tests:
b) Asphalt Content, Aggregate Gradation: Once per every 500 Tons (400 mg) of mix or once every 4 hours, whichever is greater.
c) Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 1,000 Tons (900 mg) or once every 8 hours, whichever is greater.

5) Density Tests: Once every 500 Tons (450 mg) of mix or once every 4 hours, whichever is greater.
6) Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
7) Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

r. Disposal
1) Except for material indicated to be recycled, remove excavated materials from project site and legally dispose of them in an EPA-approved landfill.
a) Do not allow excavated materials to accumulate on-site.

E. Portland Cement Concrete Pavement (PCCP)

1. The Work shall consist of the construction of plain non-reinforced rigid concrete pavement on a prepared base in accordance with these Specifications and in close conformance with the lines, grades, thickness and typical cross sections shown on the plans or established by the Town / Engineer.
2. Quality Assurance
a. Comply with all applicable provisions of the Indiana Department of Transportation (INDOT) Standard Specifications latest edition, Sections 502, 610, and other applicable articles called for herein.
b. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work in this Section.
c. Contractor shall engage an independent materials testing firm to perform field testing. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
d. Testing shall include three concrete cylinder compressive-strength tests per ASTM C31 for each 10 cys of concrete placed or each day of concrete placement if less than 10 cys of concrete is placed in a day. Reports of compressive-strength tests shall include: concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
e. One slump test per ASTM C143 shall be taken for each set of cylinders cast.
f. Three test beams shall be taken and tested at intervals recommended by the independent testing agency to determine when a modulus of rupture of 550 psi per AASHTO T97 is obtained.
g. Additional Tests: Testing agency shall make additional tests of the concrete, at Contractor's expense, when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Town / Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Additional tests may include:
1) Air test per ASTM C321
2) Yield test per ASTM C138
h. The finished paving will not be accepted or considered complete until all improvements pass the testing requirements of these specifications and the permitting authority.
3. Materials
a. The materials used in concrete shall conform to the applicable INDOT Standard Specifications latest edition, Section 502 – Portland Cement Concrete Pavement and shall meet the requirements of the following subsections of INDOT Standard Specifications latest edition, Section 901.
1) Admixtures 912.03
2) Coarse Aggregate, Class AP, Size 8 904

3)	Fine Aggregate, Size No. 23	904
4)	Fly Ash	901.02
5)	Ground Granulated Blast Furnace Slag	901.03
6)	Portland Cement	901.01(b)
7)	Rapid Set Patching Materials	901.07
8)	Water	913.01
9)	Joint Materials	906
10)	Reinforcing Steel (If Specified)	910.01
11)	Concrete Curing Materials	912.01 & 912.02 or As Noted

4. Mix Design:
   a. Portland Cement Concrete
      1) The mix design shall conform to INDOT Standard Specifications latest edition, Sections 502.04 and 502.05.

2)	Portland cement content	564 lbs/yd3
3)	Maximum water/cementitious ratio	0.487
4)	Maximum cement reduction for GGBFS replacement	30%
5)	70 Fly Ash/portland cement substitution ratio	1.25 by weight
6)	Maximum cement reduction for fly ash replacement	20%
7)	GGBFS/portland cement substitution ratio	1.00 by weight
8)	Slump, formed	2 in. to 4 in.
9)	Slump, slipformed	1.25 in. to 3 in.
10)	Air	5.0% to 8.0%
11)	Minimum flexural strength, third point	
12)	loading, with fly ash	550 psi at 28 days
13)	Relative yield	0.98 to 1.02

   b. High-Early Strength Concrete
      1) The mix design shall conform to INDOT Standard Specifications latest edition, Sections 502.04 and 502.05.
5. Preparation
   a. The construction of the subgrade shall conform to the lines, grades and cross sections as shown on the plans and INDOT Standard Specifications latest edition, Section 502.07 and provisions thereto for subgrade preparation.
   b. During subgrade preparation and after its completion, adequate drainage shall be provided at all times to prevent water from standing on the sub-grade.
   c. Prior to placement of the pavement, proof-rolling of the sub-base shall be required as evidence that the sub-base is in a firm and unyielding condition and completed with a uniform density. Complete proof-rolling operations per the requirements of these Specifications. All soft and yielding material that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. Paving material shall not be placed on a soft, spongy, frozen or otherwise unsuitable subgrade, sub-base or base.
   d. A leveling course is not required as long as the finished sub-grade / sub-base conforms to the lines, grades and cross sections as shown on the plans. However, should a leveling course be used, it shall be the material as specified for the subbase.
6. Subbase
   a. The construction of the subbase shall conform to the details shown on the plans and to INDOT Standard Specifications Section 502.08.
   b. Prior to placement of concrete, the subgrade or subbase shall be thoroughly moistened, but the method of moistening shall not be such as to form mud or pools of water.

7. Forms
    a. The subgrade beneath the forms shall be cut to grade and compacted so that the forms, when set, will be firmly in contact for their whole length and at the required elevation. The forms must be set and secured so as to resist springing, settlement or other movement resulting from the placement of concrete against them or from the weight or vibration of any equipment they support.
8. Curing Materials
    a. Curing shall conform to INDOT Standard Specifications latest edition, Section 504 and provisions thereto providing for curing.
    b. Concrete shall be cured by protecting it against loss of moisture, rapid temperature change or mechanical injury for at least ninety six (96) hours after placement.
    c. Approved materials for use in curing include double burlap cloth, waterproof paper blankets, white burlap polyethylene sheets and liquid membrane forming compounds.
    d. Other methods may be approved; however, the Town / Engineer's prior approval is required.
9. Joints
    a. Joints shall be in accordance with INDOT Standard Specifications latest edition, Section 503 and provisions thereto providing for joints. Longitudinal and transverse joints are required for all concrete pavements.
    b. Construction Joints:
        1) Place transverse construction joints at the end of concrete pouring operations if more than 30 minutes has elapsed.
        2) Transverse construction joints and reinforcing shall be in accordance with INDOT Standard Specifications Section 503.03(c) and associated INDOT standard drawings.
        3) Longitudinal construction joints and reinforcing shall be in accordance with INDOT Standard Specifications Section 503.03(d) and associated INDOT standard drawings.
    c. Expansion Joints:
        1) Expansion joints shall be in accordance with INDOT Specification Section 503.03(f) and associated INDOT standard drawings.
        2) Place joints at the beginning and end of all curb returns and at the interface between new concrete pavement and existing concrete pavement, concrete curbs, site structures, and building foundations. The maximum interval between expansion joints shall be as shown by the Town / Engineer, except the maximum interval shall be 50 feet if not specified otherwise.
        3) A one (1) day preformed expansion joint shall be placed at the end of each day's work and a one half (1/2) inch preformed expansion joint shall be made around all box outs for manholes and/or inlets and other structures.
    d. Contraction Joints And Longitudinal Joints:
        1) Transverse contraction joints, reinforcing dowels, and sealant shall be in accordance with the requirements for INDOT Type D-1 Contraction Joint in INDOT Standard Specifications Section 503.03(a) and associated standard drawings.
        2) Longitudinal joints, reinforcing, and sealants shall be in accordance with INDOT Standard Specifications Section 503.03(b) and associated standard drawings.
        3) Provide joints at the locations identified on the site drawings. If joints are not shown the length between transverse contraction joints (Type D-1 contraction joint) shall not exceed eighteen (18) feet and in no case shall a transverse construction joint be placed less than ten (10) feet apart.
        4) Transverse contraction joints shall be placed at every inlet, manhole or other structure in line of the pavement. The location of these structures shall determine the exact location of the joints. All joints shall be extended throughout the pavement section and curbs to the full width.

5) Transverse joints shall match existing adjacent joint patterns.
6) Whenever the width between forms of pavement under construction is greater than sixteen (16) feet, longitudinal joints shall be constructed so as to divide the pavement into strips.

10. Construction Requirements
    a. Concrete construction shall comply with INDOT Specification Sections 502, 503, and 504.
    b. Placement of concrete shall be in accordance with INDOT Specification Section 502.09 and 502.12.D.
    c. Finishing of concrete shall be in accordance with INDOT Specification Section 502.14 and 504.
    d. Comply with requirements and with recommendations in INDOT Specification Section 502.10 and ACI 304R for measuring, mixing, transporting, and placing concrete.
    e. Unless noted otherwise, do not add water to concrete during delivery, at project site, or during placement.
    f. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in INDOT Specification Section 502.12 and ACI 309R.
    g. Tolerance: Gap below 10-foot long, unleveled straightedge not to exceed 1/8 inch. Comply with tolerances of ACI 117 and as follows: Thickness: Plus 3/8 inch, minus 1/4 inch. Elevation: 1/4 inch.
    h. Normal Crown
        1) The pavement crown for all streets shall be computed at a minimum rate of one quarter (1/4) inch per foot, except as otherwise noted on the plans.
    i. Cold-Weather Placement:
        1) No concrete shall be placed during the period November 15 to April 15 without prior authorization.
        2) PCCP operations shall not begin until the ambient temperature is thirty five (35) degrees Fahrenheit and rising. PCCP operations shall be discontinued when the ambient temperature is descending and is forty (40) degrees Fahrenheit or below. PCCP may occur outside these temperatures when authorized in writing by the Town. Regardless of placement temperature, sufficient means shall be taken to prevent the PCCP from freezing prior to attaining opening to traffic strengths in accordance with INDOT Standard Specifications latest edition, Section 502.11 and 502.18. Any PCCP damaged by freezing shall be removed and replaced.
        3) No concrete shall be deposited on a frozen subgrade or subbase.
    j. Hot-Weather Placement:
        1) Hot weather conditions will produce a rapid rate of evaporation of moisture from the surface of the concrete and accelerated setting time. Adjustment will need to be made to the PCCP mix to ensure proper handling, placing, finishing, and curing as the weather becomes just slightly warmer and climatic factors of high winds, low relative humidity, solar radiation are present at the project site and as temperatures rise above seventy five (75) degrees Fahrenheit.
        2) In the case of hot weather conditions, effective precautions shall be implemented and conform to the American Concrete Institute (ACI) 305R Standard Specifications latest edition, Hot Weather Concreting and following procedures:.
            a) Modify PCCP mix design as appropriate. Retarders, moderate heat of hydration cement, pozzolanic materials, slag, or other proven local solutions may be used. The cement content of the mixture may be reduced while ensuring the concrete strength will be attained, with approval from the Town.
            b) Have adequate manpower to quickly place, finish, and cure the concrete.

c) Limit the addition of water at the job site and add water only on arrival at the job site to adjust the slump. Water addition shall not exceed about two (2) to two and half (2 ½) gallons per cubic yard (10 to 12 L/m3). Adding water to concrete that is more than one and half (1 ½) hours old should be avoided.

d) On dry and/or hot days, when conditions are conducive for plastic shrinkage cracking, dampen the subgrade, forms and reinforcement prior to placing concrete, but do not allow excessive water to pond.

e) Begin final finishing operations as soon as the water sheen has left the surface; start curing as soon as finishing is completed. Continue curing for at least 3 days; cover the concrete with wet burlap and plastic sheeting to prevent evaporation or use a liquid membrane curing compound described in ACI 306, or cure slabs with water. Retention of moisture will optimize the cement hydration process and allow the concrete to develop its full strength potential. Failure to keep exposed surfaces from drying excessively fast may result in cracking and shrinking, and jeopardizes the PCCP integrity.

f) Do not use accelerators unless it is common practice to avoid plastic shrinkage cracking and expedite finishing operations. Obtain written approval of Town.

3) Pavement shall be closed to traffic for fourteen (14) days after it is placed. Unless test beams are taken and tested to indicate a modulus of rupture of at least 550 psi. The beams shall be tested as simple beams with third point loading in accordance with ASTM C78 except:

a) The beam size shall be measured to the nearest one sixteenth (1/16) inch instead of one tenth (1/10) inch.

b) The test results shall be discarded when the break occurs outside the middle one third (1/3) of the beam.

F. Driveways: Existing driveways where disturbed or damaged by construction shall be replaced to the line, grade and cross section of the original drive. The various types of drive shall meet the following specifications.

1. Concrete:
   a. Private Approach: All concrete driveways shall consist of not less than 6 inches of Portland cement concrete.
   b. Commercial Approach: All concrete driveways shall consist of not less than 9 inches of Portland cement concrete.
   c. All concrete driveways shall be constructed upon a compacted sub-base all as set forth in Part 4 of these minimum specifications, unless otherwise set out in the Special Conditions and made part of the Town approval.
2. Asphalt:
   a. Residential:
      1) Eight-inch (8") depth #53 aggregate compacted in two layers of equal depth.
      2) Three inch (3") depth of HMA 19mm Intermediate Type B
      3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.
   b. Commercial:
      1) Ten-inch (10") depth #53 aggregate compacted in two layers of equal depth.
      2) Three inch (3") depth of HMA 19mm Intermediate Type B
      3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.
   c. Industrial:
      1) Fourteen-inch (14") depth #53 aggregate compacted in two layers of equal depth.
      2) Three inch (3") depth of HMA 19mm Intermediate Type B
      3) One and one half inch (1-1/2") depth of type HMA 9.5 mm Surface Type B.

G. Stone and Gravel Drive Replacement

1. Stone and gravel replacement shall consist of eight inches of compacted #73 crushed limestone upon a compacted subbase.

H. Grading and Seeding

1. All grading and seeding shall be in accordance with the project's approved Rule 5 SWPPP and "Erosion Control Plan".
2. The Contractor shall provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to furnish and install all lawns and grasses.
3. Review installation procedures under other sections and coordinate the installation of items that must be installed with, or before, lawns and grasses. If applicable, notify other contractors in advance of the planting of lawns and grasses to provide them with sufficient time for the installation of items that must be installed with, or before, lawns and grasses
4. The project site disturbed by construction shall be rough graded to a uniform and level grade prior to fine grading and seeding. All surplus or borrowed material necessary for completion of the fine grading shall be placed by the Contractor. All areas to receive seeding shall be shaped, trimmed, raked uniform smooth, free from clods, rocks and other deleterious matter.
5. Quality Assurance
    a. Source Quality Control:
        1) Provide topsoil that is of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, rocks, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial wood seeds, and shall not contain objectionable plant material.
        2) Provide sod procured from areas having growing conditions similar to location of Site.
        3) Machine-cut sod into rectangular sections, exercising care to retain the native soil on the roots of the sod, during stripping, transportation and planting.
        4) Cut and move sod only when soil moisture conditions are such that favorable results can be expected.
        5) Rectangular sections of sod may vary in length but shall be equal in width and of a size that permits the sod to be lifted and rolled without breaking.
        6) Seed that has been stored at temperatures, or under conditions not recommended by the seed Supplier, or has become wet, moldy, or otherwise damaged, shall not be acceptable.
6. Project Conditions
    a. Environmental Requirements:
        1) Proceed with and complete lawn and grass planting as rapidly as portions of the Site become available, working within the seasonal limitations for each type of lawn and grass planting required.
        2) Proceed with planting only when current and forecasted weather conditions are favorable to successful planting and establishment of lawns and grasses.
            a) Do not spread seed when wind velocity exceeds five miles per hour.
            b) Do not plant when drought, or excessive moisture, or other unsatisfactory conditions prevail.
        3) Begin maintenance immediately after each area is planted and continue until acceptable growth is established.
        4) Herbicides, chemicals and insecticides shall not be used on areas bordering wetlands.
    b. Scheduling:
        1) Plant during one of the following periods:
            a) Spring Planting: April 1 to June 15.
            b) Fall Planting: September 1 to October 30.
            c) During other periods, the time of planting shall be determined by the Town / Engineer.

c. Water & irrigate lawn and grass plantings as required to obtain adequate establishment of lawns and grasses.

7. Topsoil:
   a. Seeding / Sodding: INDOT Section 914.01
   b. All soil accepted as topsoil, whether obtained from on-site or off-site sources, shall comply with specified topsoil requirements.
   c. Provide fertile, friable, natural topsoil, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than 1-inch in diameter, or other extraneous material harmful to plant growth, in compliance with ASTM D 5268.
   d. Topsoil Source: Reuse surface soil stockpiled on-site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. If not suitable amend topsoil to meet requirements approved by the Town / Engineer. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
      1) Supplement acceptable on-site soil with manufactured topsoil from off-site sources, when quantities available on-site are insufficient to complete the Work.
8. Lawn Grass Seed:
   a. Lawn Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by INDOT 621. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, specified.
   b. Seed Species:
      1) Apply “Lawn Grass Seed” at proportion by weight as follows:
         a) 50 percent Premium Grade Kentucky Bluegrass (2 Types)
         b) 50 percent perennial ryegrass (2 Types)
         c) 0 percent noxious weeds
         d) Or as approved otherwise.
      2) Apply “General Purpose Mixture” at proportion by weight as follows:
         a) The general purpose mixture shall be “Seed Mixture R” in accordance with INDOT 621.06, or approved equal.
      3) The Town may revise seed mix requirements on a project-specific basis.
9. Turf Grass Sod:
   a. Comply with INDOT Standard Specifications, latest edition, Section 914.07.
   b. Sod shall be a variety or blend of Kentucky Bluegrass or fescue cut to a height of 2 to 3 inches, and shall be free from all primary and noxious weeds.
   c. Provide strongly rooted machine-cut sod, not less than 2 years old of uniform density, color and texture from a similar climate region. Provide only sod capable of vigorous growth and development when planted (viable, not dormant) and in strips no less than 16 inches wide and shall be no less than 2 feet in length. Edges of sod shall be cut to a uniform thickness of no less than 3/4-inch (excluding top growth and thatch).
10. Fertilizers:
    a. Provide commercial grade complete fertilizer of neutral character, consisting of fast- and slow release nitrogen with an analysis of 12-12-12, in accordance with Indiana Department of Transportation Standard Specification Subsection 914.03.
11. Mulches:
    a. Provide air-dry, clean, mildew- and certified seed and weed free, mulch. Mulch may consist of straw, excelsior mulch, wood cellulose fiber mulch, excelsior blanket, paper mat or straw mat, in accordance with Indiana Department of Transportation Standard Specification Subsection 914.05.
12. Water:
    a. Provide water acceptable for lawn and meadow application and containing no material harmful to plant growth and establishment and in accordance with Indiana Department of Transportation Standard Specification Subsection 914.09 (a).

13. Examination
    a. Contractor shall examine the areas and conditions under which lawn and grass Work is to be performed, and notify Town / Engineer, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Town / Engineer.
14. Preparation
    a. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
    b. Provide erosion-control measures to prevent erosion or displacement of seeded soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
    c. Confirm that subgrade is at proper elevations and that no further earthwork is required to bring the subgrade to proper elevations. Provide subgrade elevations that slope parallel to finished grade and towards subsurface drains shown.
    d. Remove all construction debris, trash, rubble, and all extraneous materials from subgrade. In the event that fuels, oils, concrete washout, or other material harmful to plant growth or germination have been spilled into the subgrade, excavate the subgrade sufficiently to remove all such harmful materials and fill with approved fill, compacted to the required subgrade compaction level. Removed materials to be disposed of in a legal manner.
15. Fine Grading
    a. Reset and realign curb boxes and meter boxes to ensure proper alignment and plumbness upon fine grading.
    b. Immediately prior to dumping and spreading topsoil, clean subgrade of all stones greater than 1 inch and all other extraneous matter. Remove all such material from Site.
    c. Notify Town / Engineer that subgrade has been cleaned, and obtain approval prior to spreading topsoil.
    d. Do not attempt to spread excessively wet, muddy or frozen topsoil. Do not spread topsoil more than five days before seeding or planting.
    e. Spread topsoil to a minimum depth of three (3) inches but not less than required to meet finish grades after light rolling and natural settlement.
    f. The area to be seeded shall be made smooth and uniform and shall conform to the finished grade and cross section shown on the Drawings or as directed by the Town / Engineer.
    g. Incorporate fertilizers, after spreading Topsoil, as specified, and at a rate of:
        1) Fertilizer: 18 pounds per 1,000 square feet.
16. Conventional Seeding
    a. General: Maintain grade stakes until removal is mutually agreed upon by all parties concerned.
    b. Rake or harrow all seedbeds immediately prior to seeding to produce a rough, grooved surface, no deeper than 1 inch. Seed only when seedbed is in a friable condition and not muddy or hard.
    c. Sow seed using a spreader or seeding machine.
    d. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.
    e. Sow lawn grass seed mixture at the rate of not less than 5 pounds for every 1,000 square feet.
    f. All seeded areas shall be thoroughly mulched by a method approved by the Town / Engineer. Mulching material shall be applied uniformly in a continuous blanket at a rate of 92 pounds per 1,000 square feet. Mulch shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally with a mulch tiller. Care shall be exercised to obtain a reasonably even distribution of mulch incorporated into the soil.

g. Using a uniform fine spray, irrigate lawn and grass plantings as required to obtain adequate establishment of lawns and grasses.
h. Reseed areas that remain without mulch for longer than 3 days.
i. Take precautions to prevent damage or staining of construction or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
j. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched areas. Reseed areas damaged as a result of such activity.

17. Sodding Lawns
    a. Prepare, lay, and water sod per the requirements of INDOT Standard Specifications, latest edition, Section 621.
    b. Do not lay sod on ground that is frozen, dust dry or that has not been uniformly prepared, as specified. Do not lay dormant sod.
        1) Lay sod within 24 hours of harvesting.
    c. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod.
    d. Place sod strips in straight lines parallel to one another.
    e. Lay sod across angle of slopes exceeding one on three.
    f. Anchor sod on slopes exceeding one on three and steeper, and in ditches with grade steeper than one percent. Space anchors as recommended by sod Supplier, but not less than two anchors for each sod strip to prevent slippage. Use the following anchor dimensions:
    g. Wood Peg Anchors: 1/2 inch x 3/4 inch x 12 inch minimum.
    h. T-shaped Wire Pins: Machine bent from 8 gauge low carbon steel with a minimum if an 8 inch leg, a 4 inch head, and a 1 inch secondary drive.
    i. Immediately upon completion of a section of sodding, tamp, roll lightly and water to ensure contact with subgrade and elimination of air pockets.
    j. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
    k. Immediately after planting, water sod thoroughly with a fine spray. Water sufficiently to ensure penetration of moisture to bottom of prepared topsoil layer; not just to bottom of sod blanket.

18. Reconditioning Existing Lawns and Grass Areas
    a. Recondition existing lawn damaged by Contractor's operations, including areas used for storage of materials or equipment and areas damaged by movement of vehicles. Recondition existing lawn and grass areas where minor regrading is required.
    b. Provide fertilizer, seed or sod and soil amendments, as specified for new lawns and grass areas, and as required to provide satisfactorily reconditioned lawns and grass areas. Provide new topsoil as required to fill low spots and meet new finish grades.
    c. Till stripped, bare, and compacted areas thoroughly to a depth of 12 inches.
    d. Remove diseased or unsatisfactory lawn and grass areas; do not bury into soil. Remove topsoil containing extraneous materials resulting from Contractor's operations including oil drippings, stone, gravel and other construction materials.
    e. In areas approved by Town / Engineer, where substantial lawns and grass areas remain (but are thin), mow, dethatch, core aerate and rake. Fill low spots, remove humps, cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers, as required. Apply seedbed mulch, if required, to maintain moist condition.
    f. Water newly planted areas and keep moist until new lawns are established, as specified.

19. Acceptance Criteria for Lawns and Grass Areas
    a. Lawn and grass Work will be considered acceptable when:
        1) Areas Seeded with “Lawn Grass Seed” Mixture: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 square feet and bare spots not exceeding 5 inches by 5 inches.
        2) Areas Seeded with “General Purpose” Mixture: When a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 20 square feet and bare spots not exceeding 12 inches by 12 inches.
        3) Areas Sodded with “Turf Grass Sod”: When a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
20. Cleanup and Protection
    a. Promptly remove soil and debris, created by lawn and grass Work, from paved areas. Clean wheels of vehicles before leaving Site to avoid tracking soil and topsoil onto roads, walks, or other paved areas.
    b. Erect barricades and warning signs as required protecting newly planted areas from traffic. Maintain barricades throughout extended service period and remove when service period ends. Treat, repair or replace damaged lawns and meadows.
21. Inspection & Acceptance
    a. The Contractor shall replace or repair any areas damaged by erosion or which fail to grow or take root within one (1) year of the date of final acceptance of the work.
    b. Where lawns and grass areas do not comply with specified acceptance criteria, reestablish lawns and grasses and continue extended service period until lawns and grasses comply with criteria for acceptance.

5.4 **Pipe**

A. General:
   1. Sanitary setbacks shall meet all Local, State, and Federal regulations.
   2. The Contractor shall furnish and install, complete and ready for continuous operation, all new water, sanitary sewer, storm sewer pipe and appurtenances as shown on the drawings and/or herein specified. The Contractor shall furnish and follow the manufacturer's recommendations and requirements for the installation and use of the selected pipe, fittings and special appurtenances.
   3. A complete installation shall include materials, labor, all special features, appurtenances, supports, transitions between different types of pipe and structural modifications for the type of pipe furnished.
   4. Contractor shall be responsible for verification of pipe loading during construction. Pipe design is based on final installation depth and required cover.

B. Well Separation:
   1. Private Wells:
      a. All sanitary sewer lines shall be no closer than 10 feet from private wells. When sanitary sewer lines are within 50 feet of a private well then the pipe shall be watermain grade pressure rated pipe.
   2. Transient or Non-Transient/Non-Community Wells:
      a. A sanitary sewer line shall be no closer than 50 feet to transient or non-transient/non-community well. When sanitary sewer lines are within 100 feet of a transient or non-transient/non-community well then the pipe shall be watermain grade pressure rated pipe.
      b. A transient well is considered to be a well which serves a church, campground, restaurant, or has more than 15 connection for more than 60 days or serves 25 or more people for more than 60 days. A non-transient/non-community well is considered to be a well which serves a factory, daycare, school or has 15 or more connections for 6 months or serves 25 or more people for 6 months.
   3. Community Well:
      a. All sanitary sewer lines shall be no closer than 50 feet from community wells. When sanitary sewer lines are within 200 feet of a community well then the pipe shall be watermain grade pressure rated pipe.
      b. A community well is considered to be a well that serves 15 or more connections year-round.

C. Marking for Identification
   1. Marking:
      a. Each standard and random length of pipe in compliance with this specification shall be clearly marked with the following information that will remain legible during normal handling and storage.
         1) ASTM or AWWA Standard Designation.
         2) Pipe Size.
         3) Pressure/Thickness Class/Profile Number/Standard Dimension Ratio (SDR).
         4) All HDPE for water line piping shall have a blue stripe installed by the manufacturer during the pipe forming process. All HDPE for force main piping shall have a green stripe installed by the manufacturer during the pipe forming process. The pipe in either case shall have multiple stripes so as to be viewed from any angle along the pipe.

D. Quality Assurance
   1. Qualifications
      a. Manufacturer shall have a minimum of five (5) years of experience producing pipe and fittings of the materials specified, and shall be able to submit documentation of at least five (5) installations in satisfactory operation for at least five (5) years.
   2. Component Supply and Compatibility:
      a. All pipe of each material type shall be furnished by the same manufacturer.
      b. Pipe Supplier shall prepare and review all Shop Drawings and other submittals for all materials furnished under this section.
      c. Materials shall be suitable for specified conditions of service and shall be integrated into overall assembly by Pipe Supplier.
   3. Quality of materials, process of manufacture and finished pipe shall be subject to inspection by Town / Engineer.

E. Replacement of Existing Pipes and Appurtenances
   1. Unless shown or noted otherwise on the drawings, all existing sewer lines, water lines, drainage tile, culverts, or other pipe conduits or appurtenances that are disturbed by construction shall be repaired or replaced with the same type and size as encountered. The cost of all such repair or replacement shall be the Contractor's responsibility.
   2. The location of all repaired lines shall be furnished to the Town / Engineer Representative as part of the As-Built Record Drawings. The information provided shall indicate the size, depth and material of the line as well as the size and material utilized in making the repair.

F. Conditions of Service
   1. General:
      a. Pipe materials shall be suitable for services intended.
      b. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
      c. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated in the Contract Documents.
      d. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the municipal utility.
      e. Clean rework or recycled material generated by the manufacturer's own production may be used as long as the pipe or fittings produced meet all the requirements of this Section.

G. Polyvinyl Chloride (PVC) Piping (Gravity, Non-Pressure, Storm & Sanitary)
   1. Buried PVC Gravity Sewer Pipe (Diameter < 18 inch).
      a. Material (SDR 35):
         1) Pipe shall comply with ASTM D3034.
         2) Wall Thickness and Pipe Stiffness: Pipe stiffness shall be determined in accordance with test methods in ASTM D3034.
            a) Main Line & Service Laterals: SDR 35, with minimum ring stiffness of 46 psi.
            b) Service Laterals: SDR 35, with minimum ring stiffness of 46 psi.
      b. Fittings:
         1) Gasketed fittings shall comply with ASTM D3034.
         2) Unless otherwise shown or indicated, saddle wyes are unacceptable.
      c. Joints:
         1) Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
         2) Jointing lubricant shall be as recommended by pipe manufacturer.

3) Provide elastomeric gaskets complying with ASTM F477 and ASTM D3212.

H. Ductile Iron Pipe, Joints, and Fittings (Pressure & Non-Pressure, Storm; Permitted for Sanitary with Written Approval Only):

1. Flanged pipe shall only be used inside buildings or structures. It shall not be used in a direct bury application unless noted otherwise.
2. Flanged Pipe: Fabricate in accordance with AWWA C115.
   a. Pressure Rating: As specified in on Contract Drawings. If not otherwise specified, 3 inch to 12 inch diameter pipe shall be a minimum Pressure Class 350 in accordance with AWWA C150. Pressure main pipe with a diameter larger than 12 inch shall be a minimum Pressure Class 250 in accordance with AWWA C150.
3. Non-Flanged Pipe: Conform to AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
   a. Pressure Class:
      1) 3 inch diameter through 12 inch diameter shall be a minimum Pressure Class 350 in accordance with AWWA C150.
      2) Larger than 12 inch diameter shall be a minimum Pressure Class 250 in accordance with AWWA C150.
   b. Special Thickness Class: As specified on the Drawings / Piping Schedules.
4. Pipe Joints:
   a. Flanged Joints: Conform to AWWA C110 and AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure noted on Contract Drawings.
      1) Gaskets: Unless otherwise specified, gaskets shall be at least 1/8 inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.
      2) Bolts: Comply with ANSI B18.2.1.
         a) Exposed: ASTM A307, Grade B.
         b) Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
      3) Nuts: Comply with ANSI B18.2.2.
         a) Exposed: ASTM A563, Grade A, Heavy hex.
         b) Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.
   b. Mechanical Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure rating or special thickness class, and test pressure specified.
      1) Glands: Ductile iron.
      2) Gaskets: Plain tip.
      3) Bolts and Nuts: High strength, low alloy steel in accordance with AWWA C111. Cor-Blue or approved equal.
   c. Push-On Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure class or special thickness class, and test pressure specified.
      1) Gaskets: Vulcanized SBR, unless otherwise specified.
      2) Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.
      3) Products and Manufacturers: Provide one of the following:
         a) Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, Canada Pipe Company, Ltd., McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.
         b) Fastite Joint by American Cast Iron Pipe Company.
         c) Tyton Joint by U.S. Pipe and Foundry Company.

d) Or equal.

d. Restrained Joints: Restrained joints shall comply with AWWA C110 or AWWA C153. Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of Town / Engineer.

1) Products and Manufacturers: Provide restrained joints for mechanical joint piping by one of the following:
   a) Megalug, Series 1100, by EBBA Iron Sales, Inc.
   b) RomaGrip, by Romac
   c) One-Lok, by Sigma
   d) Star Grip 3000 Series, by Star Pipe
   e) Or approved equal.
2) Products and Manufacturers: Provide restrained joints for push-on joint piping by one of the following:
   a) Super-Lock Joint Pipe, by Clow Water Systems, a division of McWane, Inc.
   b) Lok-Ring Joint, or Flex-Ring Joint, by American Cast-Iron Pipe Company.
   c) TR Flex Joint, by U.S. Pipe and Foundry Company.
   d) Snap-Lok, by Griffin Pipe Products Company.
   e) Or equal.
3) Bolts and Nuts: Shall have Cor-Blue or approved equal corrosion protection.

5. Pipe Fittings
   a. Flanged and Push-On Joint Fittings: Comply with AWWA C110/AWWA C153 and AWWA C111.
      1) Material: Ductile iron.
      2) Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.
   b. Mechanical Joint Fittings: Comply with AWWA C110/AWWA C153 and AWWA C111.
      1) Material: Ductile iron.
      2) Glands: Ductile iron.
      3) Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.
6. Cement-Mortar Lining:
   a. Unless noted otherwise in the Contract Documents, pipe and fittings shall be lined with bituminous seal coated cement-mortar lining in accordance with AWWA C104.
7. Specials:
   a. Transition Pieces:
      1) Provide suitable transition pieces (adapters) for connecting to existing piping. Submit for approval prior to construction.
      2) Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.
8. Exterior Surface Preparation and Coatings
   a. Buried Pipe and Fittings:
      1) Asphaltic Coating: Coat pipe and fittings with an asphaltic coating approximately 1 mil thick, in accordance with AWWA C151, AWWA C115, AWWA C110, and AWWA C153, as applicable.
   b. Fusion Bonded Epoxy Coating for Fittings
      1) When specified, fittings shall be factory coated with 100 percent solids, thermosetting, dry powder epoxy, in conformance with AWWA C116.

I. Polyethylene Encasement
1. When specified, provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.

2. Supply polyethylene in tubes or sheets.
3. Polyethylene encasement materials shall be in accordance with AWWA C105.
4. In addition, polyethylene encasement for use with ductile iron pipe and fitting systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils.
5. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.
6. Lumps of clay, mud, cinders etc. on the pipe surface shall be removed prior to installation of the polyethylene encasement.
7. Polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement with the minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as, bell-spigot interfaces, bolted joints or fittings and to prevent damage to the polyethylene caused by backfilling operations.
8. Overlaps and ends shall be secured with adhesive tape or plastic tie straps.
9. Installations below the water table tube-form polyethylene should be used with both ends thoroughly sealed with adhesive tape or plastic tie straps at the joint overlaps.
10. Circumferential wraps of tape shall be placed at 2 foot internals along the barrel of the pipe.
11. Provide polyethylene wrap for fire hydrant leads and valves if specified in Contract Documents.

J. HDPE Pressure Pipe for Water Main or Sanitary Force Main

1. Quality Assurance
    a. Manufacturer's Qualifications:
        1) HDPE pipe and fittings manufacturers and distributors shall be listed as current members of the Plastics Pipe Institute (PPI).
        2) Contractor shall have a minimum of five (5) years of recent experience installing HDPE pressure pipe and fittings for at least the specified pipe and fittings sizes and lengths and shall be able to submit documentation of at least five (5) installations in satisfactory operation for at least five (5) years.
        3) Fusion operators shall have received current training & certification per PPI TN-42.
2. Conditions of Service
    a. General:
        1) Pipe shall be capable of withstanding a minimum recurring surge pressure (water hammer) flow velocity of 4 ft/sec, 55 cycles/day, and 100-year estimated fatigue life, or higher if shown in the Drawings. Occasional and fire flow velocity of 10 fps per NFPA 24.
3. Dimensions:
    a. Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with AWWA C901 and/or AWWA C906 and/or ASTM F714.
    b. Wall thickness DR 11.
    c. HDPE pipe 4" diameter and larger shall be DIPS.
4. The pipe shall meet the requirements of the applicable AWWA C901 and/or AWWA C906 and/or ASTM F714.
5. Pipe shall be pressure rated to meet the service pressure requirements specified by Town / Engineer.
6. Pipe material used for the manufacture of HDPE shall be high density polyethylene (HDPE) having a material designation code of PE 4710 or higher, meeting the requirements of ASTM D3350 with a minimum cell classification of PE 445574C. Pipe material shall be listed in PPI TR-4 and NSF-61 (for potable water only) and have an allowable stress (HDS) of 1000 psi at 73°F.
7. Only smooth wall HDPE will be permitted.
8. Approved manufacturers are: See list on plasticpipe.org.

9. Physical Properties
   a. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

Property	Unit	Test Procedure	Value
1. Material Designation	-	PPI/ASTM	-
2. PPI Material Listing	-	PPI TR-4	PE 4710
3. Material Classification	-	ASTM D 1248	III C 5 P34
4. Cell Classification	-	ASTM D 3350	345434C or 355434C
5. Density	g/cm3	ASTM D 1505	>0.941
6. Melt Index (E)	g/10 min	ASTM D 1238	<0.15
7. Flexural Modulus	psi	ASTM D 790	>110,000
8. Tensile Strength	psi	ASTM D 638	<160,000
9. ESCR (C)	hours	ASTM D 1693	3,000-3,500
10. HDB	psi	ASTM D 2837	1,600 @ 23°C
11. UV Stabilizer (C)	%carbon black	ASTM D 1603	2 to 3
12. Elastic Modulus	psi	ASTM D 638	110,000
13. Brittleness	Temp F	ASTM D 746	<-180
14. Vicat Softening	Temp F	ASTM D 1525	255
15. Thermal Expansion	in/in/ F	ASTM D 696	8 x 10E-5
16. Hardness	Shore D	ASTM D 2240	64
17. Molecular Weight Category	-	-	Extra-High

   b. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90 percent of the nominal.

10. HDPE Joints
   a. General:
      1) Joints shall be as specified in the Contract Documents. If not specified, provide ductile iron flanged joints for exposed pipe fittings and ductile iron mechanical joints for buried pipe fittings.
   b. Butt Heat Fusion Joints:
      1) Shall be allowed for joining lengths of pipe in a straight run only.
      2) Shall conform to ASTM F2620 and PPI TR-33.
      3) Joint strength shall be equal to or greater than the strength of the pipe, as demonstrated by testing requirements.
   c. Special Transition Pieces:
      1) Provide suitable transition pieces (adapters) for connecting to existing piping or MJ valves.
      2) Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.
      3) All transitions shall be DIPS DR 11 fused MJ adapters by ISCO or approved equal. Follow all manufacturer recommendations.
      4) All connection to existing pipe shall use a thrust collar.
   d. Electro-fusion Couplings
      1) When utilized, electro-fusion couplings shall contain heating coils located at the sealing surface.
      2) Use ISCO Industries, Plasson USA, Integrity Fusion Products or approved equal. Follow all manufacturer recommendations.

e. Thrust Collars
    1) Contractor shall account for impacts of temperature expansion and contraction when installing and connecting HDPE pipe to existing systems. Where shown on Plans, connections to existing pipe shall use a thrust anchor. Thrust collar detail shall be submitted to and approved by Town / Engineer prior to construction.

11. Fittings
    a. Ductile iron fittings: Refer to ductile iron fitting specifications.
    b. HDPE fittings:
        1) Provide molded HDPE fittings, manufactured in accordance with AWWA C906 and ASTM D3261.
        2) Match the pressure rating and dimensions of the mainline pipe material.
        3) The following are acceptable manufacturers:
            a) ISCO Industries
            b) Plasson USA
            c) Integrity Fusion Products
            d) Or approved equal.
12. Pipe Stiffeners
    a. Provide support using pipe stiffeners.
    b. Use stiffeners constructed of stainless steel, per ASTM A240 Type 304.
    c. The outside diameter of the stiffener must match the inside diameter of the pipe.
13. Electrofusion Saddles
    a. When required by the plans in lieu of tapping saddles, provide electrofusion saddles manufactured in accordance with ASTM F-1055 and conform with the following material requirements:
        1) Pre-Blended resin 4710 which complies with ASTM D3350.
        2) Resin must be acceptable for use with potable water and comply with NSF Standard 61.
14. Joint Restraint: Provide restrained joints where shown or indicated.
    a. Proposed restraint system shall be submitted to the Town for review and approval.
    b. Restraint system shall be per the recommendations of the pipe manufacturer and appropriate for the fitting to pipe connection.
        1) Mechanical Joint Fitting Restraint:
            a) EBAA Megalug Series 2000PV
            b) Or approved equal.
        2) Push On Fitting Restraint
            a) EBAA Series 15PF00
            b) Or approved equal.
        3) Flange Adapter & Restraint
            a) EBAA Megaflange Series 2100
            b) Or approved equal.
    c. Bolts and Nuts: Shall have Cor-Blue or approved equal corrosion protection.
15. Source Quality Control
    a. At a minimum, incoming polyethylene materials shall be inspected for density in accordance with ASTM D 1505 and melt flow rate in accordance with ASTM D 1238. All incoming polyethylene materials shall be certified by the Supplier. Certification shall be verified by Contractor and submitted to Engineer. Incoming materials shall be approved by Manufacturer's Quality Assurance Program before processing into finished goods.
    b. Representative Samples of polyethylene materials shall be tested against the physical property requirements required herein. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production Samples and performing sustained pressure tests in accordance with ASTM D 1598.

c. Quality Assurance test for representative pipe and fitting Samples shall include:

Test	Standard	Pipe	Fittings
Ring ESCR	ASTM F 1248	Yes	Not Applicable
Sustained pressure at 176°F/725 psi hoop stress: (fo>100 h)	ASTM D 1598	Yes	Yes
Sustained pressure at 73°F/1,600 psi hoop stress: (fo>1000 h)	ASTM D 1598	Yes	Yes

d. The HDPE pipe and fitting manufacturer shall certify that Samples of their production pipe have undergone stress regression testing, evaluation, and validation in accordance with ASTM D 2837 and PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the pipe and fitting manufacturer to be 1,600 psi at 73.4°F and 800 psi at 140°F.

e. Material shall be listed in the name of the HDPE pipe and fitting manufacturer as required by the Plastics Pipe Institute (PPI) in PPI TR-4 with the following Standard Grade ratings:

		73.4°F	140°F
1)	Hydrostatic Design Basis (HDB)	1,600 psi	800 psi
2)	Hydrostatic Design Stress (HDS)	800 psi	400 psi

PPI material listing in the name of the resin Supplier is not acceptable in meeting this requirement.

f. Inspection Requirements:
   1) Certification: As the basis of the acceptance of the material, the manufacturer will furnish a certificate of conformance of these Specifications upon request.
   2) All outgoing materials shall be inspected for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut. Manufacturer's Quality Control Program shall perform tests of density, melt flow rate, carbon content, and carbon dispersion. In addition, Samples of the pipe provided shall be tested for hoop tensile strength and ductility by either quick burst in accordance with ASTM D 1599 or ring tensile strength in accordance with ASTM D 2290. Molded fittings shall be subject to x-ray inspection for voids, and tests for knit line strength. All fabricated fittings shall be inspected for fusion quality and alignment.

g. Test Methods:
   1) Flattening: Three specimens of pipe, a minimum of 12-inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes. Remove the load, and examine the specimens for splitting cracking or breaking.
   2) Pipe Ring Stiffness Constant: The pipe ring stiffness constant shall be determined utilizing procedures similar to those outlined in ASTM D 2412. The stiffness of HDPE pipe is defined in terms of the load, applied between parallel plates, which causes one percent reduction of pipe diameter. Test specimens shall be a minimum of two pipe diameters or four feet in length, whichever is less.

h. Pipe may be rejected for failure to conform to these Contract Documents or the following:
    1) Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment shall be rejected if defects exist in more than five percent of shipment or delivery.
    2) Cracks sufficient to impair strength, durability or serviceability of pipe.
    3) Defects indicating improper proportioning, mixing, and molding.
    4) Damaged ends, where such damage prevents making satisfactory joint weld.
    5) Gouges or scrapes exceeding ten percent of the specified wall thickness.

i. Quality Control and Quality Assurance Report: The pipe and fitting manufacturer shall maintain permanent QA records.

K. PVC Pressure Pipe for Water Main or Sanitary Force Main

1. Buried PVC Pressure Pipe (Diameter ≤ 12 inch):
    a. Material:
        1) Pipe shall comply with one of the following, as specified on the Plans:
        2) AWWA C900; Material per ASTM D1784, Class 12454; (water or force mains) or
        3) ASTM D2241; Material per ASTM D1784, Class 12454 (force mains only)
        4) Wall Thickness: DR 18 for AWWA C900 PVC or SDR 21 for ASTM D2241.
        5) Fabricate AWWA C900 pipe with ductile iron pipe equivalent outside diameter.
    b. Fittings:
        1) Provide ductile iron fittings; see ductile iron pipe specifications.
    c. Joints:
        1) Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
        2) Jointing lubricant shall be as recommended by pipe manufacturer.
        3) Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.
2. Buried PVC Pressure Pipe (Diameter 14 inch to 24 inch):
    a. Material:
        1) Pipe shall comply with AWWA C905.
        2) Material shall comply with ASTM D1784, Class 12454-B.
        3) Wall Thickness: SDR 18.
        4) Fabricate pipe with ductile iron pipe equivalent outside diameter.
    b. Fittings:
        1) Provide ductile iron fittings; see ductile iron pipe specifications.
    c. Joints:
        1) Provide bell and spigot joints. Bell shall consist of an integral wall section to hold securely in place (and prevent displacement during assembly of joint) elastomeric O-ring gasket.
        2) Jointing lubricant shall be as recommended by pipe manufacturer.
        3) Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.
3. Restrained Joints: Provide restrained joints where shown or indicated.
    a. PVC push-on joint piping:
        1) Ford Uni-flange Block Buster 1350
        2) EBAA Megalug Series 1600
        3) Or approved equal.
    b. PVC Pipe to Mechanical Joint
        1) EBAA Megalug Series 2000PV
        2) Or approved equal.
    c. Bolts and Nuts: Shall have Cor-Blue or approved equal corrosion protection.

L. Pipe Tracing Wire

1. Tracer wire shall be required on all water mains, water services, force mains, and sanitary sewer laterals.
2. All wire utilized for tracing wire shall be designed for and approved by the manufacturer for use in buried low voltage applications and approved by the Town / Engineer.
3. Provide - No. 10 or stronger high strength copper clad steel reinforced with HDPE insulation tracing wire rated for a minimum tensile strength of 600lbs. The following materials are acceptable:
    a. Soloshot Copperhead Industries, LLC
    b. BoreTough, Agave Wire, LTD
    c. Or approved equal
4. Splice tracing wire together with the following material:
    a. DRYCONN Direct Bury Lug Aqua
    b. Agave Direct Bury lug DWTWC-003
    c. Or approved equal
5. Installation
    a. Tracing wire shall be laid directly over the pipe and attached to the pipe at regular intervals not to exceed ten (10) feet.
    b. Attach the tracer wire to the pipe using plastic “zip” strapping or metal wire.
    c. The following technique shall be used to splice wires together:
        1) Use direct bury lug and strip the wire to 5/8”.
        2) Place one stripped conductor into the lug.
        3) Tighten the set screw till it comes in contact with the solid conductor.
        4) Note the location of screwdriver and continue tightening the set screw ¾ turn for # 10 solid copper wire.
        5) Repeat the steps for the adjacent side.
        6) Remove sealant cover and discard. Close housing, aligning conductors until housing lid is fully latched.
    d. For valves, the wire shall be brought up the outside of the valve or curb box riser or cleanout. Construct an opening in the lip of the valve box or curb box to allow the top of the tracer wire to be stored inside the box. Ensure that the opening is sized adequate so the cover will fit snug onto the box, once the tracer wire is installed. The wire should be installed with an excess length of 4-6 inches that is to be folded down in the valve box.
    e. For cleanouts, the wire shall be brought up the outside of the cleanout. Wrap a minimum of 12” of wire around the outside of the cleanout within four inches of grade. No tracing wire should be drawn up inside or terminated inside a cleanout.
    f. Successful completion of conductivity test to be completed by the Contractor and in the presence of the Town / Engineer. Successful completion of the test will be required prior to acceptance of main.

M. Service Laterals:

1. All gravity sewer laterals shall be minimum four inch (4”) diameter (or match existing lateral size if greater) SDR-35 PVC pipe conforming to the same specifications as the main line gravity sewer. Four inch diameter pipe shall be installed at a minimum slope of 2.0% and six inch diameter pipe at a minimum slope of 1.0%.
2. Connection to the main line gravity sewer shall be by means of a wye or tee installed with the main line sewer. In the event that a tap is made into an existing sewer, same shall be accomplished utilizing a manufactured wye or tee with rubber hub adapters or, only if approved in writing, a saddle on the pipe.
3. All gravity sanitary lateral stubs shall be installed to the right of way line.
4. Pressure sewer service lateral shall be 1.25” inch minimum HDPE in accordance with AWWA Standard C-901.

5. Buried Piping Identification Tracing for Service Laterals.
    a. Install tracing wire for service connections in accordance with the Contract Drawings and these Specifications. Tracing wire shall be installed from the mainline sewer to the building cleanout, where it is brought up to grade.
6. The end of each gravity sewer lateral shall be marked with a #4 rebar extending from the end of the lateral to a point 1.5 foot below grade and a wood stake (2" x 2" x 3') or 1-inch PVC pipe extending to a point 1.5 foot above grade, except when connecting existing service laterals.
7. The end of each pressure sewer lateral shall terminate at the property line or easement line with a curb stop and box, check valve, and watertight plug. The location of the plug shall be marked with a wood stake (2" x 2" x 3') or 1 inch PVC pipe extending to a point 1.5 foot above grade, except when connecting existing service laterals.

N. Relocation of Existing Sewer Mainline: Sewer mainline to be relocated shall be replaced with the same type and size material as existing. A separate Maintenance Bond will be required for the portion of relocated sewer mainline. The Bond shall be in a form and in the amount approved by the Town and shall be with an approved Bond provider.

O. Replacement of Existing Pipes and Appurtenances: Unless shown or noted otherwise on the drawings, all existing sewer lines, water lines, drainage tile, culverts, or other pipes or appurtenances that are disturbed by construction shall be repaired or replaced with the same type and size material as encountered. Existing sanitary sewers noted to be abandoned shall be permanently plugged with concrete.

P. Installation
1. General
    a. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.
    b. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from Town / Engineer before proceeding.
    c. Town / Engineer will observe excavations and bedding prior to laying pipe by Contractor. Notify Town / Engineer in advance of excavating, bedding, pipe laying, and backfilling operations.
    d. Minimum cover over buried piping shall be as follows:
        1) Gravity sanitary sewer mains: 4 feet
        2) Gravity sanitary laterals: 3 feet
        3) Sanitary force mains: 5 feet
        4) Unless otherwise shown or approved by Town / Engineer on a project specific basis.
2. Quality Assurance
    a. Regulatory Requirements:
        1) Comply with requirements and recommendations of authorities having jurisdiction over the Work, including.
            a) Indiana Title 327 Water Pollution Control Division
            b) Indiana Department of Environmental Management
3. Cleaning Pipe and Fittings
    a. All lumps, blisters, and excess coatings shall be removed from the bell and spigot end of each pipe.
4. Separation of Sewers and Potable Water Piping or Potable Water Structures
    a. Sanitary setbacks shall meet all Local, State, and Federal regulations.
    b. Horizontal Separation:
        1) Existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten feet.

2) If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undistributed earth shelf on one side of sewer and with bottom of potable water main at least 18 inches above top of sewer.

3) No water main should be located within 8 feet of a sanitary or storm sewer manhole as measured from the outside edge of the water main to the outside edge of the structure.

4) Exception:

a) Where the minimum clearance cannot be maintained or the location of the water line or well is unknown, the sewer must be constructed of waterworks grade ductile iron pipe with mechanical joints or PVC pressure pipe with a SDR rating of 26 or less with mechanical or compression fittings and pressure tested per the minimum separation requirements as set out in 410 IAC 6-8.1-36.

c. Vertical Separation:

1) Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses potable water main.

2) Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.

3) Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.

4) Exceptions:

a) Where the minimum clearance cannot be maintained or the location of the water line or well is unknown, the sewer must be constructed of waterworks grade ductile iron pipe with mechanical joints or PVC pressure pipe with a SDR rating of 26 or less with mechanical or compression fittings and pressure tested per the minimum separation requirements as set out in 410 IAC 6-8.1-36.

b) Encase either potable water main or sewer in watertight carrier pipe extending ten feet on each side of crossing, measured perpendicular to potable water main.

d. Separation of Sewer Mains and Potable Water Structures:

1) Private Wells: All sanitary service lines shall be no closer than 10 feet from private wells as measured from well casing. When sanitary service lines are within 50 feet of a private well then the pipe shall be watermain grade pressure rated pipe.

2) Sanitary setbacks shall meet all Local, State, and Federal regulations.

e. Sanitary lines shall be no closer than 10 feet from surface water bodies, as measured from outside of pipe and outside of grinder pump stations.

5. Plugs (Bulkheads)

a. Temporarily plug installed pipe as directed by Town at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

b. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.

c. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.

d. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to Town / Engineer.

6. Bedding Pipe

a. Bed pipe as specified and in accordance with the Contract Documents and the requirements in the Excavation & Backfill section of these Specifications.

b. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
c. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
d. Bedding to be shaped to provide continuous bearing support to pipe for full length. Bedding to be shaped to receive bell and maintain bearing support on remainder of pipe.
e. Do not lay pipe until Town / Engineer approves bedding condition.
f. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

7. Alignment
   a. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by Town / Engineer.
   b. Slope piping uniformly as shown on the Drawings.
   c. Maintain reference line and grade with laser equipment daily for adjustment and accuracy. Correct deficiencies in equipment, reference line and reference grade. Take precautions to prevent deflections in reference line and grade.
   d. Contractor shall install sewer pipe in compliance with slope requirements shown on the Drawings.
   e. Contractor shall test every section of installed sewer pipe for compliance with design slope.
   f. Installation by Directional Drilling Method:
      1) Grade for directional boring of pressure sewer shall be monitored and recorded from the “head” of the boring equipment. Care must be maintained to assure that high points do not occur that do not provide for a properly designed “air release valve.”
      2) HDPE pipe installed by the directional drilling method shall be performed by a qualified Contractor with a minimum of 3 years experience. All Contractors’ personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Each employee must have at least two years directional drilling experience. Contractor shall provide documentation of qualification.
      3) HDPE pipe installed by the directional drilling method shall be at a grade of no less than 1 percent. Grade shall be maintained at plus or minus 0.04 foot. An electric walkover tracking system or a Magnetic Guidance System (MGS) probe, or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturer's specifications of the vertical depth of the borehole at sensing position at depths up to fifty feet and accurate to 2-feet horizontally, in any soil condition, including hard rock.
      4) The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on the drawings. The vertical elevation shall be relative to the project benchmark. If the Contractor is using a MGS, drill path will be surveyed for any surface geo- magnetic variations or anomalies. The Contractor shall keep daily records in a manner acceptable to the Town of the actual location horizontally and vertically of the pipe installation, and all utility facilities found during the installation. The vertical elevation information for the pipe shall be recorded relative to the project benchmark. The information shall be recorded at a maximum of 25 foot intervals and be kept available to the Town at all times. Before final acceptance by the Town of the system, this profile information must be filed with the Town.
      5) The reamer type shall be at the Contractor's discretion with the final hole opening being a maximum of 1.5 times larger than the outside diameter of the pipe.

6) Where pipe is to be installed by directional drilling method, the Town reserves the right to require soil borings.

8. Laying Pipe
   a. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:
      1) Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.
      2) Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55, ASTM F645.
      3) Sanitary and Storm Sewers: ASCE 37.
   b. Each piece shall be opposite or near the place where it is to be laid in the trench. Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench, piece by piece, by means of a crane, rope or other suitable tools or equipment, in such a manner so as to prevent damage to main materials and to protective coatings and lining. Under no circumstances shall main materials be dropped or dumped into the trench.
   c. Slope piping uniformly between elevations shown.
   d. No pipe lengths shorter than 6 ft are permitted without written approval of the Town / Engineer.
   e. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.
   f. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by Town / Engineer.
   g. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by Town / Engineer.
   h. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.
   i. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly cleaned and dried immediately before pipe is laid.
   j. Field cut pipe, where required, with machine approved by manufacturer for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe. Breaking of the pipe with any type of hammer will not be permitted.
   k. Do not place blocking under pipe, unless specifically approved by Town / Engineer for special conditions.
   l. Touch up protective coatings in manner satisfactory to Town / Engineer prior to backfilling.
   m. Notify Town / Engineer in advance of backfilling operations.
   n. On steep slopes, take measures acceptable to Town / Engineer to prevent movement of pipe during installation.
   o. Thrust Restraint: Where required by specifications or shown on Contract Documents, provide thrust restraint.
   p. Exercise care to avoid flotation when installing pipe in cast-in-place concrete, and in locations with high groundwater. The Contractor shall take all precautions necessary to prevent flotation of the pipe due to water coming into the trench. Any damage from flotation or water entering the trench shall be corrected by removing that section which becomes damaged and repairing or replacing it.

9. Joining Pipe
    a. All pipe joints shall be made up in strict accordance with the pipe manufacturer's recommendations. Joints not tight shall be disassembled, thoroughly cleaned, and remade. Under no conditions shall bolted joints be made tight by overstressing the bolts, or tightening the bolts beyond the manufacturer's recommended range of torque. The Contractor shall provide and have available for the use of the Town / Engineer Representative on the job at all times, properly calibrated indicating torque wrenches to fit all joint bolts being used. Joints found to have bolts tightened above the manufacturer's recommended maximum torque shall be disassembled, cleaned, and properly remade as directed by the Town.
    b. Slip joints and other rubber gaskets type pipe joints shall be installed in strict accordance with the manufacturer's recommendations. Lubricants other than those recommended by the pipe manufacturer shall not be used. Joints found to be not tight or with the plain end not sufficiently inserted into the socket shall be disassembled, thoroughly cleaned and properly installed. The plain end shall not be inserted beyond the manufacturer recommendations into the receiving end.
10. Backfilling
    a. Conform to applicable requirements of the Excavation & Backfill Specifications herein.
    b. Place backfill as Work progresses.
11. Connections to Meter Assemblies, Backflow Prevention Assemblies, Valves, and Hydrants
    a. Install meters, backflow prevention, valves and hydrants as shown and indicated in the Contract Documents.
    b. Provide suitable adapters when meter assemblies, backflow prevention assemblies, valves or hydrants and piping have different joint types.
    c. Provide thrust restraint at all meter assemblies, backflow prevention assemblies, hydrants, and at valves.
12. Transitions from One Type of Pipe to Another
    a. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
    b. All connections from gravity PVC pipe to other classes of gravity pipe shall be by approved compatible fittings or rubber gaskets with stainless steel bands equivalent to and / or manufactured by Fernco or Indiana Seal.
13. Setting Valves and Fittings
    a. Valves, fittings, plugs and caps shall be set and jointed to the pipe in the manner specified for cleaning, laying and joining pipe.
    b. Cast iron valve boxes shall be firmly supported, and maintained centered and plumb over the operating nut of the valve, with box cover flush with the surface of the finished pavement or finished grade of the surrounding area or any such other level as may be directed.
14. Thrust Restraint
    a. Provide thrust restraint on piping systems where shown or indicated in the Contract Documents.
    b. Thrust restraint may be accomplished by using restrained pipe joints. Harnessing buried pipe permitted only if approved by Town / Engineer in writing. Thrust restraints shall be designed for axial thrust exerted by test pressure specified on Contract Drawings, or 150 psi for water mains or 100 psi for force mains if not listed on Drawings.
    c. Restrained Pipe Joints:
        1) Pipe joints shall be restrained by means suitable for the type of pipe being installed.
            a) Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system; or other suitable joint restraint system, subject to the approval of Town / Engineer.

b) Thermoplastic and HDPE Joints: Where bell and spigot-type or other non-restrained joints are utilized, provide proprietary restrained joint system; or other suitable joint restraint system, subject to the approval of Town / Engineer.

d. Provide joint restraint for the minimum lengths noted below:
   1) Project Engineer shall submit for approval a joint restraint length schedule for each diameter and material of piping utilized on the project and requiring restraint. Restraint lengths shall be based on approved calculation methodology by DIPRA, EBAA Iron's Restraint Length Calculator, or approved equal, using the following parameters:
      a) a minimum safety factor of 1.5,
      b) the test pressure specified on the drawings,
      c) a Type 3 trench,
      d) and the appropriate soil classification.

15. Work Affecting Existing Piping
   a. Operation of existing valves shall be by Town only.
   b. Taking Existing Pipelines and Underground Facilities Out of Service:
      1) Do not take pipelines or Underground Facilities out of service unless specifically listed in the Contract Documents or approved by Town / Engineer.
      2) Notify Town / Engineer in writing prior to taking pipeline or Underground Facilities out of service.
      3) Shutdown notification shall be provided twenty-four (24) hours in advance of the shutdown in accordance with the General Conditions and Contract Documents. Notice to affected occupants, Fire Department, Owner, and Town / Engineer is required.
      4) Shutdown not to exceed four (4) hours. Stand-by service to be provided as required.
   c. Work on Existing Pipelines or Underground Facilities:
      1) Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.
      2) Prevent contamination of existing facilities. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
   d. Salvage all hydrants, valve boxes, & curb boxes removed and deliver to Town unless noted otherwise by the Town. Remove with caution to avoid damage to hydrant or box.

16. Records
   a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.
   b. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.
   c. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
   d. Each sewer and water fitting, structure, tap location, or valve box shall be referenced to three permanent monuments. All service tap lines shall be measured from the building corners on the property served. The Contractor shall keep accurate and complete records of the actual location of all fittings, existing pipes, repair of existing utilities or tiles, tap locations into the main and the depths of the service laterals at the point of termination of the laterals.

e. Contractor shall keep accurate and complete records of the actual location of house service lateral wye, lateral end and other appurtenances, and turn said records over to the Town at the completion of the project and before final acceptance by the Town. The "AS BUILT" service connection locations shall be shown on the set of "AS BUILT" drawings as provided for in Part 3 of these standards and also typewritten on a separate sheet with property location. Each tap shall be referenced to the nearest downstream manhole, or property corner.

f. All as-built wye and connection locations shall be as shown on a set of as-built drawings by the Contractor and also typewritten on a separate page with the Owner's name and address.

17. Special Installation Instructions

a. In recognition of the fact that there are currently many different pipe materials available from many different manufacturers, the Contractor will be required to obtain from the pipe manufacturer his published recommendations for installation of his pipe, and nothing in these specifications shall preclude compliance by the Contractor with the manufacturer's recommendations. Contractor responsible to notify Engineer of conflict between manufacturer's recommendations and applicable ASTM / AWWA standards. Any pipe material and installation method not called for in these specifications and/or included in the IDEM construction permit, will need to be submitted and approved prior to construction.

5.5 **Appurtenances**

A. Quality Assurance

1. Manufacturer's Qualifications:

a. Manufacturer shall be able to provide documentation of at least five installations of substantially similar products to that specified, in satisfactory service for at least five years.

2. Component Supply and Compatibility:

a. Specified appurtenances of each type shall be furnished by a single manufacturer.

B. Conditions of Service

1. General

a. All sewer and water main appurtenances shall be constructed of the material as shown on the Drawings and as may be specified hereafter. Water appurtenance items shall be suited for services intended.

b. Sewer appurtenance items shall be suited for services intended.

C. Isolation Valves

1. Isolation valves shall be placed where a sewer branch connects to the sewer mainline and at air release valves.

D. Plug Valves

1. Valves shall be designed, manufactured and tested in accordance with American Water Works Association Standard ANSI/AWWA C517.

2. Flanged or mechanical joint plug valves shall be by Val-Matic Model 5600 Series, GA Industries ECO-Centric, Mueller, Dezurik, or equal. Grooved end plug valves shall be Victaulic Style 365 or pre-approved equal.

3. Eccentric plug valves shall be non-lubricated type, have fully encapsulated plugs and shall be of eccentric construction. Valves shall be made of cast iron, semi-steel at least equal to ASTM A126, Class B, or elastomer coated ductile iron ASTM A536 Grade 65-45-12. Body seats of valves 3-inch and larger shall have a welded-in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face. Stem bearings shall be of corrosion-resistant material. Port areas, except for 1-inch valves, shall be equal to at least 100% of the full pipe area. Valves 4-inch and larger shall have adjustable packing glands and shall be capable of being repacked without the bonnet or plug being removed from the valve. The valve shall be designed to withstand full operating pressure against the face of the plug without leakage. Grooved plug valves shall have a 360 degree opening for optimum Cv flow characteristics. Non-full-port valves will not be allowed.
4. Valves shall open left (counterclockwise). Contractor shall verify direction of opening with Town / Engineer prior to ordering.
5. Plug valves located underground shall have mechanical joint pipe connections at both ends.
6. Valves shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-close position and vice-versa.
7. Valves 4 inches thru 6 inches in size shall have a two (2) inch operating nut while eight (8) inch and larger valves shall be provided with a 2 inch operating nut on the worm gear operating mechanism.
8. Valves up to 12-inch shall have 175 psi working pressure, valves larger than 12-inch shall have 150 psi working pressure, unless otherwise noted on the Drawings.
9. Valves shall be coated with fusion bonded epoxy coating on interior and exterior, 6 mils min.
10. Install valve nut extension if valve is installed deeper than 60” cover.
11. Provide with posi-cap alignment device.
12. Valves smaller than 4 inches in size shall be as determined by Superintendent.

E. Curb Stop Valves: Curb stop valves for grinder lateral pressure sewer lines 2 inches and smaller shall be provided by the Town. All valves shall be rated for 200 psi service. Valves shall have end connections to accommodate the specified service pipe or tubing.

F. Check Valves: Check valves for grinder lateral pressure sewer lines 2 inch and smaller shall be provided by the Town. All valves shall be rated for 125 psi working pressure. Valves shall have end connections to accommodate the specified service pipe or tubing.

G. Service Saddles:
1. Tapping saddles shall be used for service taps of plastic piping. The tapping saddles and hardware shall be provided by the Town.
2. Saddles shall have a working pressure of 200 psi and have been fully tested for use on HDPE and PVC main line pipe up through 12-inch diameter.
3. Tapping saddles must be used for the installation of a corporation stop in a tapped pipe. The tap saddle is made to a specific inner diameter to match the outer diameter of the pipe. It fully supports the pipe and is sized so that the parts when bolted together cannot be over tightened on the pipe; Manufacturer’s installation instructions must be followed.

H. Cleanouts
1. Install piping so cleanouts open in direction of flow in sewer pipe. Set cleanout frames and covers as shown on the site drawings.

I. Wastewater Air Release Valves:
1. Each wastewater air valve shall be designed for its specific location: the following minimum specification shall apply. All air valves shall be installed within a concrete structure with 30” Sanitary Casting for access. Air release valves shall be as manufactured by ARI or pre-approved equal.

2. Wastewater Air Release Valve
    a. Shall be of the type that automatically releases air, gas or vapor under pressure during system operation. The valve shall have not less than a 2-inch NPT inlet with not less than a 1-inch NPT outlet and a 7/16-inch venting orifice for a maximum working pressure of 150 psi.
    b. "Back Wash Accessories" shall be furnished and assembled to the valve, consisting of an inlet shutoff valve, blow-off valve, clean water inlet valve, rubber supply hose and quick disconnect couplings.
3. Wastewater Air and Vacuum Valve
    a. Shall be of the type that automatically exhausts large quantities of air during the filling of a system and allows air to-re-enter during draining or when a vacuum occurs. The valve shall have an inlet size of not less than 2-inch NPT and a discharge size of not less than 1-inch NPT.
    b. "Back Wash Accessories" shall be furnished and assembled to the valve, consisting of an inlet shutoff valve, blow-off valve, clean water inlet valve, rubber supply hose and quick disconnect couplings.
4. Air Release Valves shall be Type B-1 ARI D-020 STST, Type B-2 ARI D0-025 TP, or approved equal.
5. The valve shall be designed to operate with wastewater with solids in a manner that will not allow discharge to the environment.
6. The valve shall have a conical shaped, made of corrosion resistant stainless steel or reinforced nylon body.
7. A cam lock back-flushing connection shall be integral to the working mechanism. A ball valve shall be provided to drain the valve.
8. The valve shall have a spring loaded stainless steel float.
9. The operating mechanism shall be non-metallic and corrosion resistant. All metal parts shall be made of corrosion resistant stainless steel.
10. The valve shall be of type that release large amounts of air, gases, and vapor during filling of the system and admits large amounts air when system drains.
11. The valve shall be capable of releasing accumulated air from the system while system is under pressure, while maintaining an air pocket separation between the liquid and the working mechanism.
12. The valve shall maintain an air pocket separation between the liquid and the working mechanism
13. The valve shall allow wastewater to drain into the system when not under pressure, allowing the internals of the valve to remain clean and unobstructed.
14. The valve shall be coated with a fusion bonded coating.

J. Valve Boxes & Curb Boxes
1. Valve boxes shall cast iron, two (2) or three (3) piece, Buffalo-style, screw type boxes. The boxes shall be five and one-quarter inch (5¼") shaft size with a round base. The word "water" or "sewer" shall be cast on the box lid as appropriate. Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length as required for depth of burial of valve, and bottom section with base of size to fit over valve. Install valve box extension if valve is installed deeper than 60" cover. Place geotextile around valve bonnet and connections of three pieces.
2. Curb boxes shall be cast iron two (2) piece, Buffalo-style, screw type boxes. The box shall be three inches (3") in diameter with a round base. The word "water" or "sewer" shall be cast on the lid as appropriate. The lid shall be held in place with a standard brass pentagon head screw.

K. Tapping Sleeve & Valve
1. The tapping sleeve and valve shall be suitable for wet installation without interrupting service. The tapping sleeve shall be suitable for the pipe material and size of the line being tapped.

2. Tapping sleeves shall be manufactured of ductile iron or stainless steel. Stainless steel sleeves shall be Type 304 steel. Sleeve shall be flanged faced and drilled per ANSI B 16.1, with standard tapping flange counterbore per MSS SP-60. Tapping sleeves shall meet minimum working pressure requirements of 200 psi for twelve inch and smaller sleeves. All tapping sleeves shall include a test plug.
3. Gasket for tapping sleeve shall completely surround pipe.
4. Nuts and bolts shall be Type 304 stainless steel.
5. Acceptable tapping sleeves:
    a. Ford FAST
    b. Romac SST III
    c. Mueller H-304
    d. Or approved equal
6. The tapping valve shall be mechanical joint x tapping flange. The flanged end shall have a raised face to match counterbore in tapping sleeve outlet per MSS SP-60. Tapping valves shall also conform to the specifications as outlined for gate valves in this Specification.

L. Installation
1. General:
    a. Install sewer appurtenances as shown, specified, and as recommended by the manufacturer.
    b. In the event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from Engineer before proceeding.
    c. Location of service connections and insertion valves indicated are approximate. Final location will be established during construction by the Town.
    d. Prior to ordering tapping sleeve assembly, expose existing main and verify circumference of existing pipe.
    e. Prior to ordering insertion valve and sleeve assembly, expose existing main at point of installation and verify circumference, actual caliper diameter and roundness of existing pipe. In addition, identify the exterior condition of the pipe with respect to pitting, scaling, electrolysis, or other defects which would affect manufacturing dimensions or exact location of the insertion.
2. Valves
    a. Install valves, valve boxes, and curb boxes as shown and indicated in the Contract Documents.
    b. Provide suitable adapters when valves and piping have different joint types.
    c. Provide thrust restraint at all valves located at pipeline terminations.
    d. Set valves plumb and on solid bearing.
    e. Install insertion valves and sleeves using personnel skilled and experienced in the use of the valve insertion machinery and accessory equipment of the type, design and size corresponding to each valve size installed. Remove section of severed water main and present to Town as proof of satisfactory execution of the operation. Town may retain coupon for further analysis or testing to evaluate the condition of existing water main.
3. Tapping Sleeve & Valve
    a. Contractor shall perform the tapping of the existing main according to the manufacturer's specifications.
    b. The Contractor shall excavate an area of sufficient size and depth, conforming to OSHA requirements, to accommodate the operations of tapping the existing line and setting the valve.

c. Assemble, align, and fit tapping sleeve and tapping valve to main using personnel skilled and experienced in making of pressure taps. In the event of mismatch of purchased materials, make necessary arrangements with manufacturer for factory refit. Any field refit will require written manufacturer and Town approval. Remove section of severed water main through tapping valve and present to Town as proof of satisfactory execution of the operation. Town may retain coupon for further analysis or testing to evaluate the condition of existing water main.

d. The Contractor shall furnish and install a valve box with the necessary extensions, backfill and compact the excavated area.

e. The Contractor shall perform a 150 psi hydrostatic pressure test, or a different pressure as required by the Town / Engineer, on the tapping sleeve and valve prior to tapping the existing water main. *Lower test pressures for air testing will be permitted only when approved in writing by the Town / Engineer.* This pressure test will be performed using the test plug provided with the tapping sleeve.

4. Valve Boxes & Curb Boxes
   a. Center and plumb valve and curb box over valve; set box cover flush with finished grade.
5. Connections and Insertions into Existing Mains
   a. Existing mains into which valves are to be inserted cannot be shut down or taken out of service. The entire operation of installing the valves shall be accomplished below 100 psig at the point of installation.
   b. Connect new mains to existing mains using proper fittings and in a manner acceptable to Town / Engineer.
   c. Expose existing mains at connection points prior to making connections with reasonable time available to determine elevation, verify type of pipe, confirm outside diameter of pipe, identify type of existing restraints, and order correct materials for connection.
   d. No cut-ins or connections to existing mains shall be made unless written approval is obtained from the Town / Engineer.
   e. Plan all connecting work to reduce number of shutoffs.
   f. Two days prior to shutting valves on existing lines, notify all affected property Owners, local official in charge of the water works system, and Town / Engineer of such shutoff.
   g. Keep shutoff time to a minimum and do at off-peak hours.
   h. A representative of Town shall operate existing valves. Contractor shall not operate existing valves.
   i. Town and Engineer assume no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.
   j. Take extreme care in making connections to prevent contamination of existing mains.
   k. Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of Town.
   l. Contractor responsible for all bypass pumping required for connection.

5.6 **Manholes & Structures**

A. General
1. Manholes and structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as directed by Town / Engineer.
2. Cast-iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified.
3. Concrete for cast-in-place manholes and structures and for inverts in precast and masonry manholes and structures shall be Class “A” and shall conform to the requirements specified hereinafter.
4. All manholes and structures shall be precast construction, unless otherwise shown.

5. Inverts shall be as shown and shall conform accurately to the size and elevation of the adjoining pipes.

B. Existing Conditions
   1. Avoid damage to the existing system. Existing manholes, catch basins, and sewers damaged by the Contractor shall be repaired to the satisfaction of the Town at no additional cost.

C. Precast Concrete Manholes & Structures
   1. Precast manholes and structures shall conform to the details shown. Provide cast-in-place concrete bases where shown.
   2. Except where otherwise specified precast manhole components shall consist of reinforced concrete pipe sections especially designed for manhole construction and manufactured in accordance with ASTM C 478, except as modified herein.
   3. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured by wet cast methods only, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.
   4. Sanitary Sewer Manholes
      a. Provide manhole with tongue and groove joints. Seal joints with all of the following methods:
         1) Rubber Gasket in accordance with ASTM C443
            a) Manufacturers: Provide rubber gasket from the following:
            b) O-Ring Gasket, by Press-Seal Gasket Corporation.
            c) Or equal.
         2) Preformed Flexible Joint Sealant in accord with ASTM C990 & AASHTO- M198.
            a) Manufacturers: Provide joint sealant from the following:
            b) EZ Stik, by Press-Seal Gasket Corporation.
            c) Kent Seal #2, by Hamilton-Kent.
            d) RU 106 RUB'RNEK LTM, by Henry Co.
            e) or equal.
         3) Butyl Rubber Backplaster-exterior
            a) Manufacturers: Provide joint sealant from the following:
            b) Trowelable EZ Stik #3, by Press-Seal Gasket Corporation
            c) or equal.
         4) Polyethylene Plastic Sheeting Film
            a) Manufacturers: Provide joint sealant as required to protect the joint from backfill operations:
            b) 6 mm polyethylene plastic sheeting film by Visqueen.
            c) or equal.
   5. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 130 pounds per cubic foot, an H-20 wheel loading, and an allowance of 30 percent impact.
   6. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
   7. The barrel of the manhole shall be constructed of various lengths of riser sections to provide the correct height with the fewest joints.
   8. Except as approved by the Town, openings in the barrel of the manholes for pipe connections will not be permitted closer than one foot from the nearest joint. Special manhole base or riser sections shall be furnished as necessary to meet this requirement.
   9. A precast or cast-in-place slab or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover.

D. Drop Connections
   1. Drop connections for sanitary sewer manholes and structures shall be constructed where shown or directed by the Town / Engineer and shall conform to the design and details shown.
   2. Concrete for pipe encasement shall be Class "A". Concrete shall be bonded to manhole in the manner shown or otherwise approved by Town / Engineer. Drop connection pipe encasement shall begin six (6) inches above the drop connection and continue to the bottom of the manhole.

E. Riser Rings
   1. Riser rings shall be used for all precast and masonry manholes and structures, where required. Stacks of riser rings shall be as specified, and shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished grade.
   2. Riser rings shall be precast concrete and shall have a minimum thickness of 2 inches and a maximum thickness of 6 inches. No more than two (2) riser rings shall be stacked together to reach the finished grade without the written approval of the Town / Engineer.
   3. Riser ring joints shall be sealed with the following method:
      a. Preformed Flexible Joint Sealant in accordance with ASTM C990 and AASHTO- M198.
         1) Manufacturers: Provide joint sealant from the following:
            a) RU 106 RUB'RNEK LTM, by Henry Co.
            b) EZ Stik, by Press-Seal Gasket Corporation.
            c) Kent Seal No 2, by Hamilton Kent.
            d) Or Approved Equal.

F. Sanitary Manhole Chimney Seal
   1. In addition to the required riser ring joint seal, provide both of the following:
      a. Butyl Rubber Backplaster-exterior
         1) Manufacturers: Provide joint sealant from the following:
            a) Trowelable EZ Stik #3, by Press-Seal Gasket Corporation
            b) or equal.
      b. Supplemental Exterior Seal: Provide one of the following:
         1) External Chimney Seal, manufactured by Cretex Specialty Products.
         2) Wrapidseal, manufactured by CANUSA-CPS.
         3) Or Approved Equal.

G. Castings
   1. Materials
      a. 24" Sanitary Casting:
         1) Material: ASTM A48/A48M, Class 35B.
         2) Products and Manufacturers: Provide one of the following:
            a) R-1772, manufactured by Neenah Foundry Company, with "Sanitary" lettered solid lid.
            b) 1022Z1, manufactured by East Jordan Iron Works, Inc, with 1020AHDGS "Sanitary Sewer" lettered solid lid.
            c) Or equal.
      b. Watertight Sanitary Casting:
         1) Material: ASTM A48/A48M, Class 35B.
         2) Products and Manufacturers: Provide one of the following:
            a) R-1772, manufactured by Neenah Foundry Company, with "Sanitary Sewer" lettered, solid, bolted lid.
            b) 1022Z1PT, manufactured by East Jordan Iron Works, Inc, with "Sanitary Sewer" lettered, solid, bolted lid.
            c) Or equal.
      c. 30" Sanitary Casting:
         1) Material: ASTM A48/A48M, Class 35B.

2) Products and Manufacturers: Provide one of the following:
a) R-1557-A4, manufactured by Neenah Foundry Company, with solid lid.
b) 1820, manufactured by East Jordan Iron Works, Inc, with solid lid.
c) Or equal.

d. 12" Cleanout Casting:
1) Material: ASTM A48/A48M, Class 35 B.
2) Products and Manufacturers: Provide one of the following:
a) R-1976, manufactured by Neenah Foundry Company.
b) 1578, manufactured by East Jordan Iron Works, Inc.
c) Or equal.

2. Fabrication, General:
a. The Contractor shall furnish all cast-iron manhole frames and covers conforming to the details shown on the Drawings, or as hereinbefore specified.
b. Castings shall be of uniform quality, free of sand holes, gas holes, shrinkage cracks, and other surface defects.
c. Castings shall be ground smooth and well-cleaned by shot blasting in the shop.
d. Design and fabricate frames and covers to prevent rocking and rattling under traffic loads that will be imposed in actual use.
e. Fabricate castings true to pattern so that component parts fit together.
f. The surface of drainage inlets shall have a casted marker that displays that it drains to waterways, as shown on Drawings.
g. Each casting shall be identifiable and, depending on its size, shall indicate the following: name of producing foundry, ASTM material designation, individual part number, and cast or heat date. Castings shall include all lettering shown or indicated on the Drawings.
h. Castings other than open grate castings are required to have a concealed pickhole.

H. Concrete Mix
1. Proportioning and Design of Class "A" Concrete Mix:
a. Minimum compressive strength at 28 days: 4,000 psi.
b. Maximum water-cement ratio by weight: 0.50.
c. Minimum cement content: 564 pounds per cubic yard.
2. Proportioning and Design of Class "B" Concrete Mix:
a. Minimum compressive strength at 28 days: 3,000 psi.
b. Maximum water-cement ratio by weight: 0.50.
c. Minimum cement content: 517 pounds per cubic yard.

I. Poured-in-Place Manhole Bases
1. Poured-in-place bases are shall be utilized only with written permission of the Town.
2. Poured-in-place bases shall be placed on suitable foundations, as shown in details, after the pipes are laid.
3. They shall be cast using class "A" concrete.
4. They shall be cast monolithically to an elevation at least 7 inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed.
5. Base, walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected.

J. Manhole Base Installation
1. Precast bases shall be set on a 6" min. crushed stone or crushed gravel foundation as shown and detailed. Precast bases shall be set at the proper grade and carefully leveled and aligned.

K. Precast Manhole Sections Installation
1. Install sections, joints and gaskets in accordance with these specifications and the manufacturer's recommendations.

2. Lifting holes, if used in manhole components, shall be repaired using a conical precast concrete plug, properly sealed into place using non-shrink cement or epoxy grout. The repair shall be clean and neat to ensure water tightness.

L. Manhole Channels
   1. Flow Channel
      a. All invert channels through manholes and structures shall be constructed of Class "A" concrete. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown or as ordered.
      b. For all sanitary sewer manholes with equal diameter influent and effluent pipes in a straight through alignment, a minimum 0.10 foot drop between the inverts of the influent and effluent pipes shall be maintained.
      c. Flow channels through a manhole shall be made to conform in shape, and slope to that of the connecting sewers. The channel walls shall be shaped or formed to the full height of the crown of the outlet sewer so that maintenance, inspection, and flow in the manhole are not obstructed.
   2. Bench
      a. Benches shall be provided on each side of the manhole channel when the pipe diameter(s) are less than the manhole diameters.
      b. Benches shall be built up to the heights shown, and shall be sloped no less than 1/2-inch per foot (4 percent), or as directed by the Town / Engineer and given a uniform wood float finish.
      c. Care shall be taken to slope all benches for proper drainage to the invert channel.

M. Manhole Steps
   1. Manholes shall be provided without steps except upon request of Town. Contractor responsible to confirm with Town if manhole steps are desired. When provided, manhole steps shall be provided at 12" to 16" spacing. Manhole steps shall be ½" steel reinforced with polypropylene plastic coating and meet the requirements of ASTM C-478.

N. Stubs for Future Connections
   1. When installing pipe stubs for future pipeline, installation of all stubs shall be properly restrained to prevent any movement. Where pipe stubs, sleeves or couplings for future connections are shown or directed by the Town / Engineer, Contractor shall provide all materials and labor in order to complete the Work.

O. Grading at Manholes & Structures
   1. Backfill shall be carried up evenly on all sides of the structures to prevent overturning forces.
   2. All sanitary sewer manholes and structures in unpaved areas shall be built, as shown or directed by the Town / Engineer, to an elevation higher than the original ground, with the ground surface graded to drain away from the manhole. All storm sewer manholes and structures in unpaved areas shall be built, as shown or directed by the Town / Engineer, with the ground surface graded to drain towards the manhole or casting. Fill shall be placed around manholes to the level of the upper rim of the manhole frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground, unless otherwise shown or directed by the Town / Engineer. The slope shall be covered with minimum 3-inches of topsoil, seeded and maintained until a satisfactory growth of grass is obtained.
   3. Manholes and structures in paved areas shall be constructed to meet the final surface grade. In paved areas on state highways, all manholes and structures shall be 1/2-inch below final wearing surfaces. Manholes and structures shall not project above finished roadway pavements to prevent damage from snowplows.

4. Contractor shall be solely responsible for the proper height of all manholes and structures necessary to reach the final grade at all locations. Contractor is cautioned that Engineer's review of Shop Drawings for manhole components will be general in nature and Contractor shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole to meet field conditions for final grading.

P. Manhole Watertightness

1. All manholes and structures shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to Town / Engineer approval. Note that sanitary sewer manholes shall be vacuum tested per these Specifications.

Q. Flexible Pipe Joint at Manhole Base for Sanitary Manholes

1. An approved flexible joint shall be provided between each pipe entering and exiting the manhole. Pipe to structure connections shall conform to the details shown. The joint into the manhole base shall be completely watertight.
2. Provide products manufactured to meet the requirements of ASTM C923.

R. Casting Installation

1. Comply with casting manufacturer's printed instructions and the Contract Documents. Install casting in accordance with requirements of manufacturer of product on which casting will be installed.
2. Set castings accurately to required location, alignment, and elevation, plumb, level, true and free of rack, measured from established lines and levels. Where applicable, brace temporarily or anchor temporarily in formwork.
3. In Paved and Unpaved Streets and Alleys:
    a. Where work is in paved streets or areas which have been brought to grade, not less than six inches (6”) and not more than twelve inches (12”) of riser rings shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished street grade. The top of the manhole casting shall be flush with the finished grade, unless otherwise directed by the Town / Engineer.
4. Within Cultivated and Non-Cultivated Areas:
    a. Where work is in cultivated areas, the top of the manhole casting shall be exposed one foot (1’) and in non-cultivated areas the casting shall be flush with the finished grade, unless otherwise directed by the Town / Engineer.

S. Connections to Existing Manholes & Sewers

1. Connections at existing manholes shall be made in a manner to prevent damaging the structure and shall be made watertight where the connection is made. Openings shall be core drilled and rubber boots shall be installed.

T. Cleaning

1. All new manholes shall be thoroughly cleaned of all silt, debris, and foreign matter of any kind, prior to final inspection.

5.7 **Sewer Tap Construction Requirements**

A. General Requirements for All Sewer Taps

1. Notify the Town at least forty-eight (48) hours prior to installing tap. Notification shall be made to an individual in Town’s main office during normal business hours. The contractor shall also review the materials list with the Town Superintendent or his authorized representative prior to beginning work. Copies of the contractor’s construction drawings shall be made available to the Town Superintendent or his authorized representative.

2. The sewer trench MUST be left open until inspected and approved by the Town Superintendent or his authorized inspector. A time shall be agreed upon between the Contractor and the Town to inspect the sewer trench. If the Town fails to show at the agreed time, the Contractor may backfill in the trench at the end of the normal work day. Contractor to take photos of open trench and pipe and connections prior to backfilling and record measurement ties of location of pipe and connections to physical features. If the Contractor is not prepared to have the sewer trench inspected at the agreed upon time, the Contractor will incur additional inspection fees to have Town return to the site to perform the inspection.
3. Some commercial installations may require an inspection (monitoring) manhole as determined by the Town Superintendent or his authorized representative.
4. A road cut permit from the appropriate authority is required whenever work enters a road and/or the road right-of-way. To include, but not be limited to, INDOT and the Steuben County Highway Department.
5. A minimum four inch (4") diameter cleanout shall be required on any gravity line leaving a structure. If outside, the clean out shall be located a maximum seven feet (7') outside the foundation wall.
6. Tracer Wire: See Pipe specification.

B. Specific Gravity Sewer Tap Requirements
1. Where an existing tap is not available on the existing gravity sewer, a new wye may be cut into the existing main line gravity sewer in accordance with the Town standard details.
2. Commercial installations may require an inspection (monitoring) manhole as determined by the Town Superintendent or his authorized representative.

C. Specific Pressure Sewer Tap Requirements
1. The Town will provide the sewer tapping saddle unless determined otherwise by the Superintendent.
2. Backflow prevention shall be installed in gravity sewer pipe between grinder pump and building within five feet (5') of the building where practical or as approved by Town Representative.
3. The Contractor shall coordinate with the Town for installation of a simplex or duplex grinder pump station to meet the applicable requirements and standards of the Town as set out in the approved permit application. The lid of tank to be two inches (2") above final grade, or two inches (2") above the 100- Year Flood Grade, whichever is higher.
4. In existing developments or tracts and in new developments the curb stop valve and box shall be located on the right-of-way line or easement line, unless otherwise approved.
5. Curb Stop Valves and Boxes shall be per Appurtenances specification.
6. The curb stop valve shall be turned on only by order of the Town Superintendent or his authorized representative and only after the inspection has been passed.
7. A check valve will be provided by the Town unless determined otherwise by the Superintendent, and shall be located between the grinder pump and the curb stop, as close to the curb stop as possible.
8. Pipe from grinder pump station to the main line shall be not less than 1.25-inch pipe for simplex station and not less than 2-inch pipe for duplex station. HDPE pipe shall conform to AWWA Standard C901. Minimum pipe cover shall be 5 feet.
9. Small Pressure Service Connections (¾-Inch Thru 2-Inch)
    a. Trenchless Service Connections
        1) The Town reserves the right to require installation of pipe under street and highway pavements by pushing or boring, in accordance with the Directional Drilling requirements of these Specifications.
    b. Ensure service connection has a minimum cover of 5 feet (5'-0").
    c. Buried Piping Identification Tracing for Pressure Service Connections.
        1) Install tracing wire for service connections in accordance with the Contract Drawings.

2) Ensure connectivity is maintained between the mainline tracer wire and the service connection tracer wire.
3) All tracing wire splices and connections shall be made using a direct bury waterproof connection device, intended for use with low voltage tracing wire.

d. For existing service connections, intercept or extend as shown or noted to connect to new water mains.
e. For existing service connection pipe to be abandoned, close the exposed end by crimping.
f. For existing service connections to be abandoned on existing water mains to remain in service, dig up (expose) and turn off the existing corporation stop at the connection to the existing main.
g. All service lines installed on mains for future use shall be installed to curb stop located within two feet of the right of way. Do not place curb box / meter box in driveway or sidewalk.
h. All service lines shall be installed with tracer wire to the water meter.

10. Large Pressure Service Connections (3 Inch and Larger)
a. Minimum cover for services shall be per the pipe installation specifications.
b. Service Connections on New Mainline
1) Install tee compatible with the mainline material.
2) Install a standard valve and valve box.
c. Service Connections on Mainlines In Service
1) Install tapping sleeve compatible with the mainline material.
2) Install a tapping valve and standard valve box.
d. All service lines installed on mains for future use shall be installed to curb stop / valve located within two feet of the right of way. Do not place curb box / valve box in driveway or sidewalk.

5.8 **Protective Coating**

A. General

1. Protective coating shall be applied to the interior of all concrete structures including, but not limited to: manholes, air release manholes, wet wells to protect the concrete structures from hydrogen sulfide and acid generated by microbiological sources present in the wastewater environment. The protective coating shall also eliminate infiltration, repair voids, and enhance the structural integrity of the structures. Coatings are not required for lift station valve vaults.
2. Cementious materials such as grouts or mortars shall not be utilized for coating and will not be considered an equivalent technology unless such coating is considered ancillary to the manhole preparation itself as it provides a clean substrate to which the coating will bond.
3. Water plugs and patches may be used only as a means of stopping leaks in order to coat the manhole. Plugs and patches shall not be considered the final solution to leakage.
4. Chimney - The cylindrical variable height portion of the manhole structure used to support and adjust the finished grade of the manhole frame. The chimney extends from the top of the cone to the base of the manhole frame.
5. Cone – That portion of the manhole structure which slopes upward and inward from the barrel of the manhole to the required chimney or frame diameter.
6. The coating limits shall include from the top of fillet, wet well walls, and roof. Coating system shall overlap 1” to 2” where hatches sit on the roof. Protective coatings shall include manhole bench and flowline for new structures. The lower limits of coatings will be assessed by the Town on a case by case basis for existing structures.
7. Applicator shall conform with all local, state, and federal regulations including those set forth by OSHA, RCRA, and the EPA and any other applicable authorities.

B. Submittals:
   1. Provide reference documentation to confirm that the proposed coating system has a proven record of performance when used in the intended application, including at least five (5) successful installations that have been in service for a period of ten (10) years. The reference list shall include the name of the facility, the application date, a contact person, and a telephone number.
   2. Certification that the equipment to be used for applying the products has been manufactured or approved by the concrete rehabilitation products manufacturer, protective coating manufacturer, and certified for proper use for this specific application.
   3. Written documentation of four (4) recent references of Applicator (involving wet wells with surface area of approximately 3,000 square feet) indicating successful application of a polyurethane or a high-build solvent-free epoxy coating.
   4. Applicator must provide written documentation of having installed a minimum of 40,000 square feet of protective coating to that specified within the last two (2) years.
   5. Patching Materials and Manhole Coatings
      a. Material type and manufacturer to be used, including catalog data showing manufacturer's clarifications and updates, ASTM references and test results, material composition, specifications, physical properties and chemical resistance, manufacturer's recommended mix, additives and set time.
      b. Manufacturer's detailed description of recommended procedures for handling and storing material to include use of strip recorder to monitor temperature at storage location.
      c. Manufacturer's detailed description of processes to execute the use of the material including equipment required.
      d. Detailed description of field testing processes and procedures.
      e. Certification that backup equipment is available and can be delivered to project sites within 24 hours.
   6. Certified statement from manufacturer that Contractor is approved installer of the material or system. Owner may request certificates of training for each crew member involved in each process from manufacturer.
   7. Documentation for products and installers must be approved by Engineer before installation of material.
   8. For each manhole rehabilitated, a complete and accurate record of work completed.
      a. Submittal shall indicate the manhole identification number, the location and quantities of rehabilitation material used, and results of post-rehabilitation inspection.

C. Quality Assurance:
   1. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the protective coating manufacturer's recommendations.
   2. Coating Manufacturer's authorized field representative shall be on site prior to the application of the coating system to verify that the substrate has been property prepared, and during the application of the coating system to certify that the coating system has been property applied. The authorized field representative will provide the Owner with an accurate and objective written report stating inspection observations on the preparation, application, and final inspection verifying adherence to coating manufacturer recommendations, industry standards, and the written specifications.

D. Examination:
   1. Contractor shall provide a minimum 24 hours notice to Town's representative for the following conditions:
      a. after final surface preparation is completed
      b. after each coating layer is applied
   2. Installation of the protective coating shall not commence until the concrete substrate has property cured in accordance with these specifications.

3. Temperature of the surface to be coated should be maintained between 60°F and 100°F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the temperature is fall versus rising (late afternoon into evening vs. morning into afternoon).

E. Materials

1. Hydraulic Water Plugs
    a. Rapid setting hydraulic water plug to plug active leaks prior to other rehabilitation Work.
    b. Initial Set Time at 70 degrees F shall be 60 to 90 seconds.
    c. Final Set Time at 70 degrees F shall be no more than one hour.
    d. Compressive Strength (ASTM C109) at 28 days.
        1) Per manufacturer's recommendation.
        2) Minimum acceptable: 4,000 psi.
    e. Length Change (ASTM C157): 0 percent.
    f. Approved Manufacturers
        1) Sauereisen, Instaplug F-180.
        2) IPA Systems, Inc., Octoplug Plus.
        3) The Strong Company, Inc., Strong-Seal Strong-Plug.
        4) AP/M Permaform, Permacast-Plug.
        5) Parson Quick Plug, Parson Environmental.
        6) Or Engineer approved equal.
2. Oil-free Oakum Water Plugs
    a. Rapid setting oil-free oakum and hydrophilic grout to plug active water leaks prior to other rehabilitation work.
    b. Oil-free oakum meeting Federal Specification HH-P-117.
    c. Two-part urethane resin.
    d. Initial set time shall be 5 to 10 minutes.
        1) Use accelerator to decrease initial set time.
    e. Approved Manufacturers.
        1) Avanti International, Oil-free Oakum (AV-219) and Multigrout (AV-202).
        2) DeNeef, Inc., Oil-free Oakum and Hydro Active Sealfoam or Hydro Active Flex LV grout.
        3) Parson Perma Seal, Parson Environmental.
        4) Spectra-Grout, SpectraTech.
        5) Or Engineer approved equal.
3. Epoxy or Polymer/Polyurethane Manhole Coatings
    a. Spray-on and Trowelable Coatings.
        1) Two or three-part epoxy or polymer resin and polyurethanes to protect concrete and steel from chemical attack.
        2) Minimum thickness.
            a) Sprayed or troweled: 80 mils.
            b) Rotary cast: 125 mils.
        3) Tensile Strength (ASTM C307): Minimum 2,500 psi.
        4) Flexural Strength (ASTM C580): Minimum 4,600 psi.
        5) Working time at 70 degrees F: 30 minutes.
        6) Initial set time at 70 degrees F: 17 hours.
        7) Approved Manufacturers.
            a) Sauereisen, Sewer Tuff No. 210, No. 210S or No. 210RS.
            b) Raven, Raven 400S or 405 ** (If using the Raven product, all manholes in any paved areas shall utilize an Engineer approved chimney sealing system)
            c) AP/M Permaform, Cor+Gard
            d) SprayRoq, Inc., SprayWall

e) Spectrashield (wastewater structures), SpectraTech
f) Madewell, Mainstay DS-5
g) Ceilcote, Ceilcote 663SG Lining
h) Strong-Seal, Epoxy, Profile Plus Mix
i) Parson, Parsonpoxy Sel-80
j) Quadex, Structure Guard
k) Or Engineer Approved Equal.

4. Riser Rings
   a. Precast concrete riser rings shall be used where required.
   b. Rings shall be a minimum nominal thickness of three (3) inches and shall conform to ASTM C478, latest revision. Ashphaltic mastic type sealant with ½" minimum thickness and 4" minimum width or nominal ½" butyl rubber base extrudable preformed gasket material shall be placed in the center of the concrete rings along with any necessary grout. The gasket material shall also be placed at the cone/slab interface and below the casting.
   c. All new manhole joints including barrel, cone, grade rings and castings, must be externally sealed using a heat-shrinkable seal such as WrapidSeal or Engineer approved equal.
5. Chimney Seals
   a. If Contractor elects to use a Raven coating system for manholes in a paved area, an internal or external chimney seal must also be provided.
   b. Chimney seals must overlap onto the casting and extend onto the cone.
   c. Approved chimney sealing methods are as follows:
      1) CIPMH Chimney Liner
      2) Cretex Internal Chimney Seal
      3) Mr. Manhole Manhole Leveling System
      4) WrapidSeal – External heat-shrink wrap at all chimney joints
      5) Products Approved in Manhole Coatings Section if approved by Engineer
      6) Or Engineer Approved Equal

F. Execution
1. Public Notification
   a. Maintain service usage throughout duration of project.
      1) Maximum amount of time without service: 8 hours for any property served by sewer. Any service out longer than 8 hours will be bypassed to a sanitary sewer.
   b. Public Notification Program:
      1) Deliver written notices to each home or business which may be affected, no more than 48 hours before commencement of work. Notice shall include contractor's telephone number for inquiries or complaints.
      2) Provide owner or occupant a summary of work to be completed, and time and duration of service interruption to building if applicable.
      3) Contact any home or business that cannot be reconnected within time stated in written notice if applicable.
      4) Provide a sample of notice to be used to the Engineer upon request.
2. Installation
   a. Temperature inside the manhole shall be between 34 degrees Fahrenheit and 100 degrees Fahrenheit during all installation and curing procedures. Provide all necessary cooling, heating, and ventilation needed to the provide optimal environment for the entire rehabilitation process. Contractor shall strictly adhere to the Supplier's cure schedule.
   b. Clean interior surfaces of manhole of debris, dirt, oil, grease, remains of old coating materials, and any other extraneous materials following approved submittals for rehabilitation products used.

c. Pressure wash manhole walls to remove loose mortar, concrete, debris following approved submittals for rehabilitation products used.
d. Repair irregularities in manhole following approved submittals for rehabilitation products used.
e. Contractor may remove existing manhole steps for ease of preparation and application of coating material at no additional cost to the Owner.
f. Repair leakage in manhole following approved submittals for rehabilitation products used. Hydraulic Water Plugs shall be used on all manholes receiving full depth coatings.
g. Any flow metering devices found in a manhole scheduled for rehabilitation shall be reported to the Engineer for coordination of removal prior to preparation for coating.
h. Trim and seal incoming laterals and pipes.
i. Remove debris from manhole and sewer.
    1) Handle cleaning water in closed discharge hoses to prevent water and residue from causing damage.
    2) Do not discharge debris through sanitary sewer system.
    3) Contractor shall be responsible for proper and legal removal and disposal of all materials in manholes to be rehabilitated.
j. Hydraulic Water Plugs
    1) Provide mechanical key by undercutting or square cutting the opening and removing loose materials per manufacturer's recommendations.
    2) Mix, handle, place and cure per manufacturer's recommendations.
    3) Finish surface per manufacturer's recommendations and as required for other rehabilitation Work.
k. Oil-free Oakum Water Plugs
    1) Saturate oakum with resin per manufacturer's recommendations.
    2) Use additives as required.
    3) Place and cure per manufacturer's recommendations.
l. Epoxy or Polymer/Polyurethane Manhole Coatings
    1) Mix and apply per manufacturer's recommendations.
    2) Sagging of epoxy coating is not permitted.
    3) Seal around pipe connections and steps.
    4) Seal at casting/chimney interface.
    5) Cure per manufacturer's recommendations
    6) If Contractor uses a rotary cast system, the following areas are required to be hand applied:
        a) precast manhole cap-barrel interfaces;
        b) pipe-manhole interfaces;
        c) bench-barrel interfaces.
m. Contractor is responsible to measure and provide thickness readings to the Inspector and on their final submittal for each manhole coating installed.

3. Testing
    a. Visual inspections shall be performed to determine integrity of rehabilitation materials and water-tightness.
        1) Provide flow-through plugs for the duration of inspection.
        2) No infiltration or inflow shall be permitted.
        3) Contractor shall repair any leakage or Work found to be unsatisfactory by Engineer.
    b. Test manhole coating for continuity following ASTM D4787 and approved submittals. Repair holes and discontinuities following manufacturer's recommendations.
4. Warranty Inspections
    a. Visual inspections may be performed by Engineer to determine integrity of rehabilitation materials and water-tightness prior to expiration of the guarantee period, preferably in spring season.

b. Contractor may accompany Engineer on inspections.
c. Engineer will inspect a minimum of 25 percent of manholes rehabilitated at locations selected by Engineer.
    1) No infiltration or inflow shall be permitted.
    2) If any manhole fails warranty inspection, all manholes on contract will be inspected by the Engineer.
d. Upon notification from Engineer of any defects found during the warranty period, Contractor shall correct all defects found in a timely manner, at no additional cost to the Owner.

5.9 Simplex / Duplex Grinder Pump Station

A. General
1. The contractor shall provide labor, material, equipment, and incidentals required to provide centrifugal grinder pumps and appurtenances as specified herein except for those portions provided and installed by the Town. The pump models covered in this specification are single phase grinder pumps. The Town shall provide, install, and own the grinder pump. The Town shall be responsible for all maintenance on the grinder pump.
2. Sanitary setbacks shall meet all Local, State, and Federal regulations.
3. The top of individual grinder pump stations shall be a minimum of 0.2 feet above the 100 year flood elevation, and shall not be placed in an area susceptible to standing water.
    a. Private Wells: All individual grinder pump stations shall be no closer than 50 feet from private wells. Less distance between grinder pump stations and wells may be considered only when waiver obtained from Steuben County Health Department. The Town reserves discretion to require the 50 foot separation even when a County waiver is obtained. In no case shall the separation distance be less that the distance from the private well to the existing septic system.
    b. Transient or Non-Transient/Non-Community Wells:
        1) All individual grinder pump stations shall be no closer than 100 feet to transient or non-transient/non-community well
        2) A transient well is considered to be a well which serves a church, campground, restaurant, or has more than 15 connection for more than 60 days or serves 25 or more people for more than 60 days. A non-transient/non-community well is considered to be a well which serves a factory, daycare, school or has 15 or more connections for 6 months or serves 25 or more people for 6 months.
    c. Community Well:
        1) All individual grinder pump stations shall be no closer than 200 feet from community wells.
        2) A community well is considered to be a well that serves 15 or more connections year- round.
    d. Grinder Pump Stations shall not be located closer than 10 feet from water lines or bodies of water.

B. Individual Grinder Pump Stations:
1. New Construction: Individual grinder pump stations for new construction shall provide service to one (1) single family dwelling or one (1) equivalent dwelling unit. Shared grinder systems are not permitted without the express written consent of the Town of Clear Lake.
2. In retrofits to existing shared grinder stations, individual grinder pump stations may provide service to two (2) single family dwellings or two (2) equivalent dwelling units provided they are residential/non-commercial. No more than two (2) single family dwellings shall be connected to a simplex grinder pump station.
3. Non-residential connections shall be to a duplex grinder pump station.

4. All new construction shall provide power to grinder stations from the property electrical service. Direct utility power is not permitted for new construction.

C. Operating Conditions:

1. Each submersible pump shall be rated at 2 hp, 240 volts, single phase, 60 Hz. 3450 RPM. The unit shall produce 25 GPM minimum at 105 feet of total dynamic head.
2. The grinder pump shall be capable of handling residential wastewater with 3” solids and grinding it to a fine slurry enabling it to be pumped over long distances in pipelines as small as 1.25" in diameter. The grinder pump shall have a shut-off head of 108 feet and a maximum flow of 50 GPM @ 10 feet of total dynamic head. Alternatively, the system shall be capable running a higher head submersible pump that has a shut-off head of 185 feet, a maximum flow of 38 GPM @ 10 feet of total dynamic head, and a minimum flow of 10 GPM @ 150 feet of total dynamic head.
3. The pump shall be controlled with:
    a. A NEMA 4X simplex control panel with three float switches and a high water alarm.
    b. Alternatively, in retrofits of existing grinder stations only and not in cases of new construction, a shared panel may be used, whereby the panel has two incoming power supplies, and alternates power sources for each pumping cycle.

D. Construction:

1. Each centrifugal grinder pump shall be equal to the c SP us certified Series LSGX Grinder pumps as manufactured by Liberty Pumps, Bergen NY. Castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a dual seal arrangement. The first seal is a double lip seal molded in FKM fluoroelastomer or Buna N.
2. The second / main seal shall be a unitized hard face silicon carbide seal with stainless steel housings and spring.
3. The upper and lower bearing shall be capable of handling all radial thrust loads. The lower bearing shall have the additional ability to handle the downward axial thrust produced by the impeller and cutters by design of angular contact roller races. The pump housing shall be of the concentric design thereby equalizing the pressure forces inside the housing which will extend the service life of the seals and bearings. Additionally there shall be no cutwater in the housing volute in order to discourage the entrapment of flowing debris. The pump shall be furnished with stainless steel handle having a nitrile grip.

E. Electrical Power Cord

1. The submersible pump shall be supplied with 25 feet of multiconductor power cord. It shall be cord type SJOOW (1-phase) or SEOOW (3-phase), capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

F. Motors

1. Simplex stations shall utilize single phase motors. Single phase motors shall be oil filled, capacitor start / capacitor run, class B insulated NEMA B design, rated for continuous duty. Duplex stations shall utilize single or three phase motors. Three phase motors shall be oil filled, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 135 degrees C unsubmerged. Since air filled motors are not capable of dissipating heat they shall not be considered equal. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump. Single phase motors shall have an integral solid state starting circuit switch for switching the start winding off.

G. Bearings And Shaft

1. An upper radial and lower thrust bearing shall be required. The upper bearing shall be a single ball / race type bearing. The lower bearing shall be an angular contact heavy duty ball / race type bearing, designed to handle axial grinder pump thrust loads. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The bearing system shall be designed to enable proper cutter alignment from shut off head to maximum load at 10' of TDH. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of 0.670".

H. Seals

1. The pump shall have a dual seal arrangement consisting of a lower and upper seal to protect the motor from the pumping liquid. The lower seal shall be a FKM fluoroelastomer OR Buna N molded double lip seal, designed to exclude foreign material away from the main upper seal. The upper seal shall be a unitized silicon carbide hard face seal with stainless steel housings and spring equal to Crane Type T-6a. The motor plate / housing interface shall be sealed with a Buna-N O-ring.

I. Impeller

1. The impeller shall be an investment cast stainless steel impeller, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be keyed and bolted to the motor shaft.

J. Cutter Mechanism

1. The cutter and plate shall consist of 440 stainless steel with a Rockwell C hardness of 55-60. The Stationary cutter plate shall have specially designed orifices through it, which enable the slurry to flow through the pump housing at an equalized pressure and velocity. The Stationary cutter shall consist of V shapes to maximize cutting action and arc shape exclusion slots to outwardly eject debris from under the rotary cutter. The rotary cutter shall have four (4) blades and shall be designed with a recessed area behind the cutting edge to prevent the accumulation and binding of any material between rotary cutter and the stationary cutter. The cutting system must incorporate close tolerances for optimum performance. Ring or radial cutters, or those that grind on the outside circumference of the rotary cutter shall not be considered equal.

K. Single Phase Simplex Control Panel (New Construction, Single Family Dwelling or One Equivalent Dwelling Unit)

1. General
    a. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a simplex motor control panel as specified herein.
    b. The motor control panel shall be assembled and tested by a controls system manufacturer meeting the Standards of UL 508A for industrial controls and be UL labeled and serialized accordingly. The motor control panel shall be assembled and tested by the manufacturer so as to insure suitability in matching controls to motors and to insure single source responsibility for the equipment.

c. The panel shall contain all components required by the pump manufacturer for starting and protecting the motor as well as features required by the pump manufacturer for warranty of the pumps.
d. Incoming pump power shall be single-phase, 60 Hz, 240 volts AC.
e. Incoming control/alarm power shall be single-phase, 60 Hz, 120 volts AC.
f. The control panel shall incorporate three (3) normally open, mechanically-activated control switches with pipe clamps. Floats shall be labeled in the panel as stop, start, and alarm. Floats shall be non-mercury, contact activated type.
g. Controls shall provide a three-way selector switch for ON-OFF-AUTOMATIC mode. ON turns the pump on, regardless of the liquid level in the basin; OFF turns the pump off, regardless of the liquid level in the basin; and AUTOMATIC operates the pump in conjunction with the floats within the basin.
    1) In Automatic Mode
        a) The pump Starts and Stops on rise or fall of water level.
        b) Activate the alarm light and sound horn in the event the water continues to rise.
    2) The pump and alarm circuit shall be controlled by a direct acting three (3) float system.
        a) The bottom float energizes the Automatic Control circuit on its rise, and de-energizes the circuit turning off the pump on its fall.
        b) The second float starts the pump on its rise.
        c) The third float activates the Alarm Light & Horn.

2. Panel Construction
    a. The controls for the pump shall be housed in a NEMA 4X enclosure with a hinged door and neoprene gasket. The enclosure shall have provisions for a padlock.
    b. The panel shall be furnished with an secondary swing out plastic inner door which allows access to only the breaker and on-off-auto switch when the outer door is opened. The secondary door must be opened to service all other control components.
    c. A nameplate shall be permanently affixed to the panel. A ratings label shall include the model number, voltage, phase, frequency, ampere rating and horsepower rating and shall be affixed to the inside of the enclosure. A warning label against electric shock shall be permanently affixed to the outer door and shall include a note that the disconnect breakers are located under this (outer) door. The interior of the enclosure shall have a clear envelope with "as built" schematics located within.
    d. All power shall be disconnected without requiring the inner door to be opened.
    e. A removable back plate shall be provided for mounting all circuit breakers, motor starters, etc. All components mounted to the back plate shall be secured by type 25, self-tapping screws in extruded holes. Rivets shall not be acceptable for securing any component to the back plate.
    f. There shall be a separate control circuit and power circuit on all residential control panels.
    g. A simplex pump controller shall be provided for control logic. The controller shall utilize a printed circuit board to avoid conventional wiring. The printed circuit board of the pump controller shall be manufactured using UL listed materials. There shall be separately fused control and alarm circuit protection. A circuit breaker shall be used for the control circuit The control circuit breaker shall extend through the inner door. A run light and on-off-auto switch shall be provided for the pump circuit. The run light and on-off-auto switch shall be mounted on the outside of the inner door. The run light shall be green.
    h. Circuit breaker(s) shall be used as branch circuit protection for each pump. The circuit breaker shall be thermal magnetic and sized to meet NEC requirements for interrupt capacity and amp rating.

i. Magnetic motor starter(s) shall be general purpose type rated for the pump horsepower and include a contactor with a minimum mechanical life of 500,000 operations and a minimum contact life of 100,000 operations. Pump overloads, if not included in the pump, shall provide overload protection for the pump circuit and shall be sized to meet NEC requirements for the pump full load ampere rating specified.

j. A high-level alarm condition shall activate the main alarm light (red, mounted on the top of the panel) and alarm horn. The alarm light shall remain illuminated until the problem is corrected. The alarm horn shall be rated 83-85 dB minimum. A Test-Normal-Silence toggle switch labeled and placed adjacent to the horn, shall be included.

k. Wire ties shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All grounding conductors shall be securely connected to assure a proper ground.

l. Mount control box within an unobstructed view of the grinder pump station at least three feet (3') above grade (but not more than five feet (5') above grade). Mount on treated 4" x 4" post with a minimum of three (3) feet of post imbedded in ground and a minimum of five (5) feet of unobstructed space in front of the control panel.

m. All work must be in accordance with 327 IAC 3-6-24, the National Electric Code and all state and local codes and requirements.

L. Dual Power Simplex Control Panel Specifications - Single Phase (Option for Retrofits of Existing Shared Grinder Stations)

1. General

a. All requirements of Single Power Simplex Control Panel specification apply except as modified herein.

b. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a dual power motor control panel as specified herein.

c. Incoming pump powers shall be single-phase, 60 Hz, 240 volts AC with Neutral.

d. The control shall alternate power supply except when power is not detected from one source, then power shall be from available source.

2. Panel Construction

a. A warning label shall be affixed to the inner door stating "the panel is powered by two separate sources, shut off power from both sources before servicing".

b. A duplex pump controller shall be provided for control logic. The pump controller shall indicate control and alarm power utilizing green LED indicator lights. The pump controller shall indicate float circuit operation utilizing red LED indicator lights. Indicator lights shall provide adequate information so that they can be used for diagnosis in troubleshooting problems located in the float circuits. Each LED shall be permanently labeled on the pump controller as to the function. On-off-auto switches shall be mounted on inner door.

c. The alternator shall consist of an alternating circuit which alternately switches house power upon the next pumping cycle. The alternation circuitry shall be integrated into the pump controller.

d. Green house power indicators shall be mounted on the side of enclosure.

M. Single Phase Duplex Control Panel (New Construction, Non-Residential Connection)

1. General

a. All requirements of Single Power Simplex Control Panel specification apply except as modified herein.

b. Controls shall provide a three-way selector switch for ON-OFF-AUTOMATIC mode. ON turns the pump on, regardless of the liquid level in the basin; OFF turns the pump off, regardless of the liquid level in the basin; and AUTOMATIC operates the pump in conjunction with the floats within the basin.

1) In Automatic Mode

a) The pump Starts and Stops on rise or fall of water level.

b) Alternate running of pumps.
c) Activate the alarm light and sound horn in the event the water continues to rise and start second pump.

2) The pump and alarm circuit shall be controlled by a direct acting three (3) float system.
a) The bottom float energizes the Automatic Control circuit on its rise, and de-energizes the circuit turning off the pump on its fall.
b) The second float starts the pump on its rise.
c) The third float activates the Alarm Light & Horn and starts the second pump.

2. Panel Construction
a. There shall be an hour meter and cycle counter for each pump.
b. A duplex pump controller shall be provided for control logic. The controller shall utilize a printed circuit board to avoid conventional wiring. The printed circuit board of the pump controller shall be manufactured using UL listed materials. There shall be separately fused control and alarm circuit protection. The pump controller shall indicate control and alarm power utilizing green LED indicator lights. The pump controller shall indicate float circuit operation utilizing red LED indicator lights. Indicator lights shall provide adequate information so that they can be used for diagnosis in troubleshooting problems located in the float circuits. Each LED shall be permanently labeled on the pump controller as to the function. For each pump a run light and hand-off- auto switch shall be provided. Run lights and hand-off-auto switches shall be mounted on the printed circuit board. Run lights shall be green.
c. The alternator shall consist of an alternating circuit which alternately switches pumps upon the next pumping cycle. The alternation circuitry shall be integrated into the pump controller.

N. Paint:
1. The exterior of the pump casting shall be protected with Powder Coat paint.

O. Support
1. The pump shall have cast iron support legs, enabling it to be a free standing unit. The legs will be high enough to allow solids and long stringy debris to enter the cutter assembly.

P. Serviceability
1. Components required for the repair of the pump shall be shipped within a period of 24 hours.

Q. Factory Assembled Tank Systems With Guide Rail And Quick Disconnect Discharge
1. Mounted guide rail system with pump shall be suspended by means of stainless steel bolt on quick disconnect which is sealed by means of nitrile grommets. The disconnect system shall have an internal ball check. The Discharge piping shall be schedule 80 PVC and furnished with a PVC shut-off ball valve. The Tank shall be wound fiberglass. A rubber inlet hub shall be provided with the fiberglass systems.
2. The Tank System for a Simplex station Shall Include the following:
a. Stainless steel Guide Rail attached to a stainless steel T-Bar Hanger
b. 30" diameter basin size
c. 96", 120”, or 144” height basin size
d. 60" distance from top of tank to top of discharge pipe outlet
e. Fiberglass cover
f. Simplex Control Panel System with Outdoor panel and alarm or Shared Control Panel System with Outdoor panel and alarm
3. The Tank System for a Duplex station Shall Include the following:
a. Stainless steel Guide Rail

b. Stainless steel "Quick tree" float mounting system
c. 36" diameter of basin size
d. 96", 120", or 144" height of basin size
e. 60 "distance from top of tank to discharge pipe outlet
f. Fiberglass cover
g. Duplex Control Panel System with Outdoor panel and alarm

R. Testing
1. The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test shall be performed to ensure integrity of the motor housing. The pump shall be run, voltage current monitored, and the tester shall check for noise or other malfunction.
2. A start up report for each pump shall be provided and include serial numbers and testing technician's name.

S. Quality Control
1. The pump shall be manufactured in an ISO 9001 certified Facility.

T. Warranty
1. The warranty shall be for all workmanship and materials for a period of three (3) years from the date of startup.

U. Installation
1. Grinder pump stations shall be located within proper easements or rights of way with clear, unobstructed view from the nearest roadway. Connection of pumping unit shall include check valves and ball valve in the discharge line. The Town shall own and provide the acceptable grinder pump station.

V. Private Pump Stations
1. If the property owner requires a private pump station to lift wastewater to the Town-owned grinder pump, the private pump shall meet the following requirements:
a. The private pump shall be owned and maintained by the property owner.
b. The private pump shall be capable of handling wastewater solids or should be a grinder pump.
c. The private pump shall not produce a flow rate in excess of 14 gallons per minute (gpm).

W. Easements
1. If a property owner within the Town plans to build across the property line adjoining two lots within the Town easement and a grinder pump or lateral is located in that easement, prior to construction the property owner shall convey to the Town a new easement satisfactory to the Town to protect the sewerage system and allow access, which new easement shall be executed and recorded prior to issuance of a building permit. The new easement and legal description will be at the expense of the property owner on forms acceptable to the Town. No structure will be permitted to be built over a sewer lateral.

X. Grinder Station Accessibility
1. Property owners shall not plant trees, flowers, shrubs or other plantings within five feet (5') of the grinder pump station. There shall be no plantings on one side of the pump facing the nearest road. The purpose of this requirements is to provide accessibility for servicing and to promote visibility of the visual alarm from the roadway. Any plantings that, as they mature, encroach within five feet (5') of the grinder pump station are subject to trimming by the Town. No structure shall be built or located within five feet (5') of a grinder pump.

Y. Private Generator Installations for Grinder Stations:

1. All work must be performed by Contractor registered with Steuben County and approved by the Town of Clear Lake.
2. Town inspection and approval of final generator installation required prior to use of generator. Use of generator without Town approval shall be considered violation and subject to fine.
3. Single-Home Grinder Installations
    a. Electrical service for any single-home grinder installation must be transferred from direct utility service to residential service. The existing control panel may remain in place.
4. Shared Grinder Installations
    a. Electrical service may remain direct from the utility. A blank meter base and electrical disconnect per electric utility standards is required to be installed on the electrical service.
    b. Electrical service may be transferred from direct electric utility service to residential service for both properties with automatic alternation between each service. A Dual Power Simplex Control Panel shall be provided per these specifications as a replacement to the existing control panel. A written agreement between both property owners shall be recorded and provided to the Town.
5. Residential Electrical Service Requirements
    a. The direct electric utility service to the grinder must be disconnected at the pole in accordance with electric utility requirements. Disconnections at the grinder panel are not permitted.
    b. An exterior electrical disconnect shall be provided at or adjacent to the grinder panel. This disconnect shall provide ease of accessibility for the Town in the judgement of the Superintendent.
    c. Residential service shall be 240V and provide 30A breaker in residence and 25A breaker at grinder.
6. Transfer Switch
    a. In the event that a privately-owned generator is provided as an emergency power source on a direct utility-powered grinder station, the Town will provide a transfer switch for installation inside a NEMA rated enclosure. The enclosure shall be lockable. Town to provide lock. The transfer switch shall be wired in accordance with the National Electric Code (NEC) and Town-provided detail for grinder station control connections.

5.10 **Submersible Pump Stations**

A. General

1. The wastewater pump stations shall be constructed at the location and grade as shown on the drawings.
2. The Contractor shall furnish all materials, labor, equipment, and services for the complete installation of duplex or triplex wastewater pump stations complete with all concrete, mechanical, electrical, controls, appurtenances, site work, and miscellaneous items of work shown, specified, or required for a complete and functional installation ready for continuous operation.
3. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.
4. Each pump station shall include any necessary bypass pumping, earth excavation, rock removal, backfill, granular material and stone, sheeting, bracing, shoring, disposal of excess materials, surface restoration, and all concrete reinforcing steel, masonry work, steps, frame and cover, pipe and fittings, and all other materials and operations necessary to complete the pump stations as set out in the specifications and plans.
5. Pump station specifics vary greatly on a project-specific basis. The Town reserves the right to allow deviations from this specification upon review.

B. Design Considerations

1. Pump stations shall be designed to adequately handle the estimated flow from the proposed development without overflow with one pump in service. In addition, the structure, internal piping and valves, electrical service and wet well shall be of sufficient size to permit enlargement of the station, by only exchanging the pumps and motors, to the capacity required to handle contributory flows from areas adjacent to, but outside, the project location.
2. The Town zoning map and comprehensive plan and the Steuben County Comprehensive Plan shall be used in conjunction with the Town / Engineer in determining the design capacity.
3. Pump design shall be based on average daily flow with a peaking factor of four times that average flow. Pump starts shall not exceed 6 per hour.
4. Unless otherwise approved, the wet well shall have a minimum of 6 ft. above the high level alarm.

C. All equipment supplied and installed under this item of the specifications shall meet the requirements of the Occupational Safety & Health Act of 1970.

D. Submittals:

1. Shop Drawings:
    a. Provide the Engineer with copies of the shop drawings as set forth in the Special Provisions.
    b. The following data shall be included for each pump station submittal.
        1) Performance Charts
        2) Pump Outline Drawing
        3) Station Drawing for Accessories
        4) Detailed Electrical Data
        5) Control Drawing and Data
        6) Access Frame Drawing
        7) Typical Installation Guides
        8) Technical Manuals
        9) Parts List
        10) Printed Warranty
        11) Manufacturer's Equipment Storage Recommendations
        12) Manufacturer's Standard Recommended Start-Up Report Form
        13) Motor Performance Curve
        14) Equipment outline drawings showing elevation, plan and interior views, front panel arrangement, dimensions, weight, shipping splits, conduit entrances and anchor bolt pattern. Indicate all options, special features, ratings, and deviations from the specifications.
        15) Power and control schematics including external connections. Show wire and terminal numbers and color coding.
        16) Drive performance specifications.
            a) The project specification shall list the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
        17) Harmonic filtering. The manufacturer shall, with the aid of the buyer's electrical power single line diagram, providing the data required by IEEE-519, perform an analysis to initially demonstrate the supplied equipment will meet the IEEE standards after installation. If, as a result of analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, then the cost of such equipment shall be included in the bid. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits.

2. Operation and Maintenance Manuals:
    a. The Contractor shall provide Town with three (3) copies of a standard operation and maintenance manual for each pump station.
    b. The instructions shall be bound and shall provide at least the following as minimum:
        1) A comprehensive index.
        2) A complete As-Built set of approved shop drawings.
        3) Detailed service, maintenance and operation instructions for each item supplied.
        4) A table listing the "as left" drive set up parameters and alarm and trip settings.
        5) The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
        6) Complete parts list with stock numbers, including spare parts.

E. Wet Well and Valve Pit:
1. The pump station wet well and valve vault shall be precast reinforced concrete sections conforming to ASTM C-478 placed on a dry compacted subgrade with a leveling course and have flat slab reinforced concrete tops. The structures shall be of the size and depth as shown on the drawings.
2. The joints of the structures shall be sealed with rubber gaskets conforming to ASTM C-443.
3. Joint between sewer pipe and structure wall shall be sealed with a rubber gasket conforming to ASTM-923.
4. Drains from the valve pits shall discharge back to the wet well.
5. The interior of all concrete structures shall be coated with a corrosion protective material as specified elsewhere after all jointing compound has cured.

F. Access Hatches:
1. The following manufacturers are acceptable for lift station access hatches:
    a. Bilco
    b. Halliday
2. Frames shall be ¼-inch extruded aluminum with an anchor flange around the perimeter. Mill finish with bituminous coating to be applied to exterior frame by manufacturer. Frame shall be securely mounted directly above the pumps or valves. The wet well shall be provided with a two (2) door hatch. The valve vault shall be provided with a single door hatch.
3. Door leaf shall be ¼-inch aluminum diamond plate reinforced with aluminum stiffeners. The door shall open to 90-degrees and lock automatically in that position. Door shall be built to withstand a live load of 300 lbs per square foot.
4. Use all stainless steel hardware. Handle shall be snap lock and removable.
5. A 1 ½-inch drainage coupling shall be provided in the right front corner of the channel frame.
6. Factory finish shall be aluminum lacquer. All surfaces in contact with concrete shall have a bituminous coating.
7. The access hatches shall be of the size required for unobstructed access or equipment removal and as approved by the Owner.
8. Each access hatch shall be equipped with aluminum safety grating.
    a. The safety grate shall be made of 6061 – T6 aluminum safety grating per the most current edition of the Specification for Aluminum Structures by the Aluminum Association, Inc.
    b. The grating shall withstand a minimum live load of 300 psf, using 17,300 psi as the design stress for the aluminum.
    c. Both the access hatch and safety grating shall be from the same manufacturer.
    d. Grate openings shall be 5-inches by 5-inches.
    e. Provide grates with a permanent hinging system, which will lock the grate in the 90-degree position once opened.
    f. Coat the grate with an OSHA type safety orange color powder coating system applied by electrostatic spray process.

G. Guide Rails:

1. Guide rails for each pump shall be installed to permit raising and lowering of the pumps. The guide rails shall be 316 stainless steel and of adequate length and strength to extend from the lower guide holders on the pump discharge connection to the upper stainless steel guide holder mounted on the access frame. Guide rails shall be installed plumb with stainless steel intermediate supports and fasteners as required.

H. Wiring Channel:

1. A wiring channel shall be mounted below the pump well cover for the pumps and shall provide cord grip holders for the pump cords and the control cords.
2. The channel box shall have a removable cover for easy adjustment of the cords.
3. All cords shall extend from one end of the box and be taken through conduit in the sump cover to the control panel.
4. No splices shall be made in the wiring channel. Continuous cords must be used from the control panel to the pumps and controls.
5. Wiring channel shall mount on supports fastened to access cover frame.
6. Alternative configurations may be submitted to Owner for review or mandated by Owner on case by case basis.

I. Plug Valves:

1. Plug valves shall be flanged or grooved. Valves shall be as previously specified.

J. Check Valves:

1. Check valves shall be of cushioned swing type and shall meet the materials requirement of AWWA C508. The valve shall be of cast iron body, bronze mounted, single gate for non-shock working pressure of 175 psi and have a 316 stainless steel hinge pin with bronze support bearings. The valve shall be constructed so that the internal working parts may easily be removed and replaced by unbolting and lifting the cover without removing the valve from the line. The valve shall be furnished with an outside lever and spring or outside lever and weight with non-corrosive adjustable air cushion shock chamber. Check valves shall be suitable for mounting in either horizontal or vertical lines when water flows is up. Check valves should close without any hammer action.
2. Valve ends shall be flanged ANSI A21.10/AWWA C110 or grooved per AWWA C606.
3. Valves shall be coated with fusion bonded epoxy coating on interior and exterior, minimum 10 mils.
4. The following manufacturers are acceptable for check valves:
    a. Val-Matic;
    b. GA Industries;
    c. Clow;
    d. M&H;
    e. Or Approved Equal.

K. Access Drive:

1. An access drive and parking/service area for each station shall be of size and type as shown on the drawings.

L. Pumps:

1. General:
    a. Each pump shall be suitable for service in raw, unscreened wastewater with 3 inch solids and shall be conform to the requirements shown on the Drawings for flow rate, total dynamic head, voltage and phase. Pump manufacturer shall be as approved by Town on case by case basis.

2. Quality Assurance:
    a. The pumps shall be heavy duty, electric submersible, centrifugal non-clog units designed for handling raw, unscreened sewage and wastewater and shall be fully guaranteed for this use. The pumps shall be capable of operating in a liquid temperature up to 104° F. as specified NEMA standards.
    b. The pump and motor unit shall be capable of continuous operation at full nameplate load while the motor is submerged, partially submerged, or totally non-submerged, unless explicitly approved otherwise by Town. The use of shower systems, secondary pumps or cooling fans to cool the motor shall not be acceptable.
    c. The pump, mechanical seals, and motor units provided shall be from the same manufacturer.
    d. All components and workmanship shall be UL-certified and bear the UL serialized label.
    e. The pump shall be tested at the factory under simulated field conditions for excessive vibration, leaks, and operation of all automatic systems.
    f. The controls shall be adjusted to start and stop the pumps to satisfy field conditions. For each unit, a pump performance curve shall be produced from the factory testing. Its veracity shall be certified and the curves shall be identifiable by serial numbers of pumps and motors. Manufacturer shall submit size copies of the certified curves to Town. Town will judge adequacy of performance and distribute copies of curves appropriately.
3. Pump Design:
    a. Requirements:
        1) Submersible non-clog wastewater pumps shall be installed at each pump station. Pump shall be installed in such a way that solids are fed in an upflow direction to the non-clog impeller with no feet, rails, or other obstructions below the inlet.
        2) Each pump shall be equipped with a close coupled, submersible electric motor connected for operation on the specified voltage with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards. The power cable shall be of adequate length so not to be in tension.
        3) The pump shall be supplied with mating cast iron discharge connection of the size shown on the plans and be capable of delivering the design flow and total discharge head. The design operating point shall be as near as possible to the best efficiency point of the selected motor. Each pump shall be fitted with a stainless steel (304/316) lifting chain. The chain shall be a minimum of 5-feet longer than the total depth of the wet well. The working load of the lifting station shall be 50% greater than the pump unit weight.
    b. Performance Criteria:
        1) The pumps shall meet the criteria of the design capacity at design head and shall not exceed the specified horsepower.
    c. Design:
        1) The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. There shall be no need for personnel to enter the wet-well to remove and replace pumps.
        2) Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.
        3) The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.
        4) Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the under side of the access frame.

4. Pump Construction:
    a. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
    b. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings.
5. Cooling System:
    a. Motors shall be sufficiently cooled by the surrounding environment or pumped media.
6. Cable Entry Seal:
    a. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
7. Pump Motor
    a. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air or oil filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180º C (356º F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour. Thermal switches shall be provided to monitor the temperature of each phase winding. The thermal switches shall open at 125º C (260º F), stop the motor, and activate an alarm. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and the pump shall be produced by the same manufacturer.
    b. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
    c. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of at least 65 feet.
    d. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
8. Bearings:
    a. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated.

9. Mechanical Seal:
    a. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub is not acceptable.
    b. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. Seal lubricant shall be FDA Approved, nontoxic.
10. Pump Shaft:
    a. Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft. The pump shaft shall be stainless steel.
11. Impeller:
    a. The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, multiple vane, non-clogging design. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency to help reduce operating costs. Impeller(s) shall be locked or keyed to the shaft and shall be capable of passing a minimum 3-inch diameter solid.
12. Wear Rings:
    a. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
13. Volute:
    a. Pump volute(s) shall be single-piece gray cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be four (4) inches.
14. Protection:
    a. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125º C (260º F), stop the motor and activate an alarm.
    b. A leakage sensor shall detect water in the stator chamber. When activated, the sensor shall stop the motor and activate a local and/or remote alarm.
15. Pump Motor Electrical Material:
    a. All materials shall be new and shall conform to the applicable standard or standards where such have been established for the particular material in question.
    b. Materials of the same type shall be the product of one manufacturer.
    c. Publication and Standards of the organizations listed below are applicable to materials specified herein:
        1) American Society for Testing and Materials (ASTM)
        2) Underwriters' Lab (UL) (UL-listed material shall bear label)
        3) National Electrical Manufacturer Association (NEMA)
        4) Insulated Power Cable Engineers Association (IPCEA)
        5) Institute of Electrical and Electronic Engineers (IEEE)
        6) Edison Electrical Institute (EEI)
        7) National Fire Protection Association (NFPA)
        8) American National Standards Institute (ANSI)
        9) American Iron and Steel Institute (AISI)

M. Control System

1. General:
    a. All of the automatic control equipment shall be supplied by one manufacturer. Panel shall be assembled, wired, tested, and covered by complete electrical drawings and instructions.
    b. All equipment, materials, and work on these panels shall be in total compliance with all state, local, federal guidelines, and shall conform to the standards by the NEC, NEMA, and IEEE.
2. Control Panel
    a. A pump station control panel shall be provided for each pumping station. The electrical control equipment shall be mounted within a NEMA Type 4X dead front enclosure, constructed of not less than 14 gauge Type 304 stainless steel. The enclosure shall be equipped with an inner door and shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Enclosure shall be equipped with a stainless steel drip lip. The enclosure shall be equipped with a single handle actuated three point latch closing mechanism and continuous hinge.
    b. Panel must be UL approved.
    c. The control panels shall be built in an UL-listed manufacturing facility. The equipment shall be designed to have a useful operating life of no fewer than fifteen (15) years with standard servicing and replacement of parts.
    d. A transformer shall be supplied to give a 115-volt control circuit.
    e. A single weatherproof 20 amp ground-fault-protected duplex convenience outlet shall be provided on the side of the control panel enclosure.
    f. The control panel shall be completely wired at the factory except for the power feed lines. Wiring diagrams matching the unit shall be provided.
    g. Motor status run light shall be provided.
    h. Light Switch – A 120 volt 20 amp light switch inside a weatherproof box mounted to the side of the control panel to activate the area light and internal control panel light.
    i. Heaters – Each panel shall include a thermostatically controlled heater for moisture control. The heater shall be 120 V AC and rated as required by enclosure size.
    j. Power Terminal – A main power terminal shall be provided for single point service termination of adequate size to accept the full size wire of the service required.
    k. Wire – Wire shall be of Type, THWN, THHN, or THW 600V, 90°C. Wiring shall be as shown on plans, or a minimum, as indicated by applicable codes (NEC, etc.) Minimum wire size shall be No. 12.
    l. Wire Markers – All control wiring to be numbered on both ends for ease of future trouble shooting. Lift station wires shall be marked on both ends.
    m. Control Circuit, Circuit Breaker – Single Pole, electromagnetic circuit breaker sized no larger than 125% of the total control circuit current.
    n. Circuit Breakers shall comply with the latest applicable standards of NEMA PB-1 and UL 67.
    o. Where circuit breakers are used as service entrance equipment, they shall comply with all NEC and UL requirements for service entrance and UL service entrance label shall be provided.
    p. Breakers must be bolt-in type, heavy duty, quick-make, quick-break, thermal- magnetic molded case circuit breakers. Breakers shall be large E-frame type. Q- frame breakers are NOT acceptable. Multi-pole breakers shall be common trip. Anti- turn solder less, pressure type connectors shall be provided suitable for aluminum/copper wire.
    q. The exterior of each enclosure is to have a weather resistant adhesive placard indicating the control panel identification number and emergency contact telephone number; lettering to be a minimum of 3/4-inches tall.

r. Circuit breakers shall have engraved plastic nameplates indicating the load served and the load rating. (Ex. HP-15HP, 30ph, 460V).
s. Do not splice conductors in circuit breaker enclosure.
t. Group and lace conductors within enclosure with nylon tie straps.
u. A door switch shall be provided to indicate access to the panel.
v. Six 20A/Single Pole breakers and two 15A/2P transformer breakers (one primary and one secondary, if applicable) shall be provided.
w. Control terminal blocks shall be of the screw clamp type, rated 600 volts.
x. Engraved nameplates shall be supplied for marking all components. The labels shall be attached with a 5 mil thick, 3M type adhesive. No foam tape will be acceptable. The labels shall be uniform in size with 1/4" minimum letter sizes.
y. The control panel shall be equipped with a high level alarm system consisting of a weatherproof red Lexan light and horn. Upon high level activation the light will flash and the horn will sound. The control panel shall be equipped with an alarm silence switch to provide maintenance personnel a means to silence the horn while corrective actions are underway however, the light shall remain on until the high level condition clears. After silencing the alarm, manual reset of the alarm signal shall provide automatic reset of the alarm silence relay.

N. Pump Controller:
1. General:
a. The manufacturer shall be capable of providing start up service.
b. The pump controller shall consist of all the components, hardware and software to provide a trouble-free pumping station. The system shall be designed and specifically produced for the surveillance of the pump station. The system shall provide for interface to other RTU's and SCADA systems for remote control and data collection. The RTU shall control the pumps as a standalone unit in the event of a communications loss.
2. Operation:
a. Pump controller shall provide continuous monitoring of the wet well level via level signal (4-20mADC). The pump controller shall start and stop pump based upon wet well level and operator programmed setpoints. The controller shall have provision for a float switch backup in event of analog signal failure. The controller shall also have provision for redundant analog level sensor. The pump controller shall alternate pump cycles to ensure equal run times. The pump controller shall monitor pump protection features to provide alarms in event of impending pump failure. It shall also monitor pump performance data to provide operations personnel the ability to evaluate station performance.

O. Liquid Level Sensor
1. Liquid level sensor shall be waste water submersible pressure transmitter/transducer type. All elements of the instrument, except the transducer, shall be contained in NEMA 4X enclosure. The Transducer shall be sealed and encapsulated for operation in the environment of a wet well The transducer shall have a quick acting internal thermal sensor the temperature correction and shall have a minimum operation range of -20 to 150 degrees Fahrenheit. Measurement range of transducer shall be 1-50 feet with a blanking zone of twelve (12) inches. Surface turbulence, electrical noise, and pump to give reliable and accurate readings. Installation shall be by manufacturers instructions.

P. Float Switches
1. Float switches shall be provided for back-up operation if the liquid level transducer fails. The entire float switch assembly shall be designed for use in raw wastewater.
2. Switches shall be of the floating ball type, with a nominal five and one-half inch (5-1/2") diameter, Teflon-coated stainless steel float ball that contains a sealed switch assembly.

3. The float shall be supported with a flexible synthetic rubber hinge fastened to an adjustable mounting bracket. The hinge shall also act as housing for the lead wires from the alarm switch.
4. The lead wire shall be a waterproof cable of such length that no spice or junction box is required in the wet well.
5. Stainless steel mounting accessories shall be furnished.
6. The switch contacts shall be single-pole-double-throw rated 4 A at 250 V AC.

Q. Flow Meter Equipment
1. Magnetic flow meters shall be furnished and installed for the purpose of measuring flow at specific locations as shown on the plans.
2. All components shall be installed and tested in accordance with the manufacturer's written instructions.
3. The flow meter shall provide an instantaneous flow and pulse totalizing flow signal for monitoring in the pump control system. Each pulse will equal one hundred (100) gallons. The instantaneous and totalized flow signals for the discharge header will be indicated and summed in the pump control system to obtain pump station discharge instantaneous flow and pump station discharge total flow.

R. Backboard
1. The backboard shall be sized as required to mount electrical panels and controls, not to be more than 6’ (feet) tall and 8’ (feet) long, once constructed. The backboard shall be aluminum. The posts shall be a minimum size 8” x 3.75” aluminum channel sunk into place a minimum of 3.5 foot. The posts shall be set with concrete and allowed to cure. As a minimum, 3000 psi concrete shall be used. The posts shall be level and plumb when the cement is cured. All equipment mounting to the backboard shall be accomplished by Stainless Steel hardware.

S. Installation:
1. Installation of the pump station and all equipment shall be done in strict accordance with written instructions by the Manufacturer. Manufacturer shall provide four (4) bound copies of these instructions to Town.
2. The Contractor shall furnish the services of factory service personnel of the equipment manufacturer to supervise the final adjustments of the system, perform operating tests, assure the Town that the equipment is in proper adjustment and satisfactory operating condition, and to instruct and train the Town's personnel in the use of this equipment. This service will be rendered after installation of the equipment has been completed and the entire system is ready for operation. Start-up and operator training shall be accomplished on two (2) separate trips to the job site.

T. Quality Control And Field Testing:
1. Contractor shall:
    a. Test all equipment for actual operating conditions to show that each unit operates satisfactorily without overheating or overloading and is free from excessive vibration and noise throughout the complete head and capacity range at rated speed.
    b. Adjust operating mechanism for free mechanical movement.
    c. Touch-up scratched or marred surfaces to match original finish.
    d. The Town shall observe all field tests. Contractor shall give three (3) days written notice to the Town before performing tests.
    e. Successful operation shall be demonstrated to the satisfaction of the Town.
    f. The Contractor shall make, at his expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory and efficient operation.

g. Pump and pump controls Manufacturers' authorized representatives shall provide written report(s) to the Town noting that pumps and controls have been installed in accordance with Manufacturers' recommendations, the materials used in construction of the pumps and controls are the same as submitted for the shop drawing approval, are in conformance with project performance requirements, and are ready for operation.

h. An authorized representative(s) shall be present for start-up of the pumps and controls.

i. On-site training in the operation and maintenance of all equipment shall be performed by factory authorized personnel with personnel from the Town.

2. Pump Test

a. Testing performed upon each pump shall include the following inspections:

1) Impeller, motor rating and electrical connections shall be checked for compliance with this specification.

2) Prior to submergence, each pump shall be run dry to establish correct rotation.

3) Each pump shall be run submerged in water.

4) Motor and cable insulation shall be tested for moisture content or insulation defects.

b. Upon request, a written quality assurance record confirming the above testing/inspections shall be supplied with each pump at the time of shipment.

c. Each pump shall be tested in the field to provide a field certified pump curve with the initial draw down documentation submitted in accordance to lift station data sheets.

d. The pump(s) shall be rejected if the above requirements are not satisfied.

3. Start-up Service:

a. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:

1) Megger stator and power cables.

2) Check seal lubrication.

3) Check for proper rotation.

4) Check power supply voltage.

5) Measure motor operating load and no load current.

6) Check level control operation and sequence.

b. Pumps shall clear the hatch of the wet well top without impedance.

c. During this initial inspection, the manufacturer’s service representative shall review recommended operation and maintenance procedures with the owner’s personnel.

U. Spare Parts:

1. The Contractor shall furnish one (1) complete set of recommended spare parts for each size pump. All spare parts are to be conveyed to the Town.

V. Cleaning

1. Remove all rubbish and debris from inside and around the equipment. Remove dirt, dust or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not used compressed air.

W. Warranty

1. Manufacturer shall warrant equipment against defects in workmanship and materials for a period of three (3) years from acceptance under normal use, operation, and service, except pumps. Warranty shall include ‘on site’ repair or replacement of equipment found defective within the warranty period. Warranty costs shall include all shipping costs.

2. The pump manufacturer shall warrant the pumps in writing against defects in workmanship and material for a period of three (3) years of normal use, operation and service. The warranty shall be in printed form and apply to all similar units. The warranty shall cover 100 percent labor and materials cost and include ‘on site’ repair or replacement of equipment found defective within the warranty period.

3. Contractor shall warrant the installation of equipment for a period of two (2) Years from acceptance; and shall include labor required to repair, replace or reinstall equipment found to be inoperative or unsatisfactory due to defective equipment or improper installation.

5.11 Standby Electrical Power System

A. General
   1. If required by the Town, the Contractor shall provide, install, and test at each submersible pump station a complete and operable emergency/standby electrical generating system, including all devices and equipment specified herein, required for services. Equipment shall be new, of good quality, and in good condition.
   2. Installation shall include the labor, equipment, tools, supplies and materials, and performance of all operations necessary for the installation of the engine-generator set, switch gear, and auxiliary equipment herein specified.
   3. Coordinate manufacturer and details with the Town of Clear Lake. The Developer / Contractor is responsible to integrate with the existing Town of Clear Lake SCADA system.

B. Quality Assurance
   1. The standby engine powered generator shall be manufactured in the by a reputable manufacturer with at least ten (10) years of experience in manufacture of similar types of engine powered generators.

C. System Description:
   1. General
      a. The equipment specified herein is intended for outdoor installation and use and operation in closed standby and/or peak shaving mode separate from the utility power source.
   2. Rating
      a. The generator set rating shall not be less than the available electrical loads at the pump station. These ratings as a minimum should be acceptable for site conditions of altitude up to 1000 ft and temperatures up to 122 deg. F.
   3. Operation
      a. Operation shall be fully automatic and shall have the capability of being monitored and initiated in response to an external contact input that shall be wired from a SCADA remote terminal unit.
   4. Performance
      a. The manufacturer shall thoroughly familiarize himself with the conditions and scope of the labor and material to be furnished as a part of this Specification.

D. References:
   1. All equipment covered by these Specifications shall be new and shall conform to the latest applicable standards of ANSI and NEMA, except where the standards conflict with the requirements of these specifications. All electrical equipment shall require UL approval for the intended use.

E. Warranty
   1. Provide a no deductible warranty for all products in this section, against defects in materials and workmanship for a period of three (3) years after final acceptance. Warranty documents shall be executed in the name of the owner as defined in the Contract Documents.

F. Approved Supplier

1. The emergency/standby power systems shall be obtained from a supplier whom shall be the manufacturer's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The suppler shall have a 24-hour service availability and factory trained service technicians authorized to do warranty service on all warrantable and non-warrantable products. Technicians are to be available on site within two (2) hours of a call.

G. Installation of Standby Power System

1. The installation shall comply with applicable state and local codes as required by the authority having jurisdiction. The Contractor shall install the equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products. Additional electrical/electronic connections will be performed as indicated in the Contract Documents.
2. The emergency/standby power system shall be mounted on a suitable foundation as indicated in the Contract Documents.

H. Installation of transfer system

1. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. The Contractor shall install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products. Additional electrical/electronic connections will be performed as indicated in the Contract Documents.

5.12 **Telemetry System**

A. General

1. Telemetry is required at each submersible lift station.
2. Contractor shall provide all work necessary for the documentation, factory test, installation, on-site radio survey, field testing and startup and final documentation for the Supervisory Control and Data Acquisition (SCADA) system for the Town of Clear Lake (Town) Pump Stations constructed under this work.
3. Provide RTUs, PLCs, Radios, antennas, additional modules, cables, and software required.
4. Major components of this system shall include the specified materials, equipment and installation required to implement a complete and operational SCADA system along with associated instrumentation.
5. Coordinate manufacturer and details with the Town of Clear Lake. The Developer / Contractor is responsible to integrate with the existing Town of Clear Lake SCADA system.

B. Responsibility for Complete System

1. The Contractor shall be responsible for and shall provide for the supply, delivery, installation, certification, calibration and adjustment, software configuration, testing and startup, of a complete, coordinated system which shall perform the specified functions. This shall include completing all necessary on-site radio signal survey and acquiring all permits.
2. The Town and Engineer will review system technical information as submitted by the Contractor for software, operating system, database, control logic and the graphical user interface, report and log formats, graphics, trends, alarming, etc. for complete compliance with these specifications.
3. The Contractor shall provide the Town with all services and hardware to ensure that proper communications are established throughout the system. This work shall include, but not be limited to:
    a. Provide and install all hardware necessary for the system.
    b. Provide a written report of the radio survey indication the signal strength, antenna height required, etc. from each RTU location to the central PLC site. This shall be completed prior to final shop drawing submittal.

5.13 **Testing**

A. General Testing Requirements
   1. All testing shall be in accordance with IDEM, INDOT or other recognized standards and regulations.
   2. Notify Town / Engineer and authorities having jurisdiction in writing at least 48 hours in advance of testing.
   3. Conduct all tests and disinfections in presence of Town / Engineer Representative.
   4. Remove or protect pipeline-mounted devices that could be damaged by testing.
   5. Provide all apparatus and services required for testing, including:
      a. Test risers and associated connections to the main, test pumps, compressors, hoses, calibrated gauges, meters, test containers, valves, fittings, and temporary pumping systems required to maintain Town's operations.
      b. Temporary bulkheads, bracing, blocking, and thrust restraints.
   6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
   7. Demonstrate that all valves in the test section are opened as appropriate for the test.
   8. Unless otherwise specified, Town will provide water required for hydrostatic testing and disinfection except for water required due to a failed test. Contractor shall provide means to convey water for hydrostatic testing into piping being tested. Contractor shall provide water for other types of testing required.
   9. All leaks, broken or cracked pipe, valves, etc. which are identified by testing shall be repaired. Any sections of main which do not meet test acceptance criteria shall be repaired or replaced. Retest after repair at no additional cost.
   10. Where necessary due to absence of valves or structures, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve or structure. Piping not installed by Contractor and that fails the test shall be repaired upon authorization of Town. Unless otherwise included in the Work, repair of existing piping or underground facilities will be paid as extra Work.
   11. Test to confirm connectivity of tracer wire.
   12. Copies of all test reports are required, or test shall be considered to have failed.

B. Test Schedule
   1. Provide hydrostatic testing for all force main piping at a test pressure of 100 psi and for all water main piping at a test pressure of 150 psi, unless noted otherwise. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
   2. Do not place potable water into the newly installed pipe until the Town is on the project site and gives the Contractor approval. Any valve opening to place potable water into the newly installed pipe shall be done by the Town.
   3. Pressure tests shall conform to the applicable AWWA and ASTM standard.
   4. Provide vacuum test of all sanitary manholes.
   5. Provide deflection and leakage testing of all gravity sanitary sewer mains.

C. Gravity Pipe Testing
   1. Deflection Test:
      a. A deflection test shall be performed on each flexible pipe following the elapse of thirty (30) days after the placement of the final backfill.
      b. No pipe shall exceed a deflection of five percent (5%) or greater.
      c. The diameter of the rigid ball or mandrel used for a deflection test shall be no less than ninety-five percent (95%) of the base inside diameter of the pipe to be tested dependent on what is specified in the corresponding ASTM standard. The test shall not be performed with the aid of a mechanical pulling device.

2. Leakage Test: All gravity sanitary sewers shall be tested per one of the following tests:
    a. A hydrostatic test shall be performed with a minimum of two (2) feet of positive head. The rate of exfiltration or infiltration shall not exceed two hundered (200) gallons per inch of pipe diameter per linear mile per day.
    b. Air test plastic pipe according to ASTM F1417-92: "Standard Test Method for Installation Acceptance of plastic gravity sewer lines using Low-Pressure Air".
3. Any piping that is damaged shall be removed and re-installed before approval.
4. An infiltration test is required only when specified by the Contract Documents.
    a. The Contractor shall furnish all weirs, bulkheads, catchments, and other appurtenances as required for performing the test.
    b. Procedure for Infiltration Testing: After the new main line pipe has been installed and the new house service laterals connected in a reach of conduit between two manholes, this reach of sanitary sewer may be tested for infiltration. This testing shall be performed through the use of a bulkhead in the upstream manhole and a calibrated sharp-edged weir installed at the downstream manhole. The infiltration flow from the reach undergoing testing shall be measured over a sufficiently long period of time to establish the rate of infiltration but in no case shall the test duration be less than two (2) hours. Where the reach being tested was installed through ground that required dewatering, the infiltration test shall not be performed until a sufficient period of time has elapsed after the dewatering equipment has been removed to permit the ground water table to return to its natural level, as agreed by the Town.
    c. Allowable Infiltration: The total quality of infiltration into the system from ground water during wet weather or from water from creeks, rivers, springs or other sources shall not exceed two hundred gallons per inch diameter of sewer, per mile, per twenty-four (24) hours (0.00263 gallon per inch diameter, per 100 feet, per minute).

D. Vacuum Testing
1. Manholes
    a. Perform vacuum test on all manholes according to ASTM C1244 prior to backfill.
    b. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
    c. Following set-up of test apparatus per manufacturer's recommendations, draw vacuum of ten inches of mercury on manhole being tested. The time shall be measured for the vacuum to drop to nine inches mercury.
    d. Start test upon reaching specified test vacuum. Test duration shall be in accordance with ASTM C1244.
        1) Minimum test times for various manhole diameters shall conform to the following table per ASTM C1244 or be 1 minute; whichever is longer:

Depth (ft)	Diameter, in.												
	48	54	60	66	72	78	84	90	96	102	108	114	120
	Time, in seconds												
<4													
6													
8													
10											63	67	71
12								62	67	71	76	81	85
14						62	67	72	78	83	89	94	100
16					69	70	76	83	89	95	101	108	114
18				65	73	79	86	93	100	107	114	121	128
20			65	72	81	88	95	103	111	119	126	135	142
22		64	72	79	89	97	105	114	122	131	139	148	156
24		64	78	87	97	106	114	124	133	143	152	161	170
26	64	75	85	94	105	114	124	134	144	155	164	175	185
28	69	81	91	101	113	123	133	145	155	167	177	188	199
30	74	87	98	108	121	132	143	155	166	178	189	202	213

e. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, manhole fails the test and shall be repaired and retested. If vacuum drop is less than 1 inch of mercury, manhole passes the test.

E. Hydrostatic Testing

1. General:
   a. All newly installed water and sanitary force mains must be pressure and leak tested prior to final acceptance.
2. Preparation
   a. Pipeline shall be laid and backfilled.
   b. Valves shall be properly located, operable, and plumb and at correct elevation.
   c. Lines shall be properly vented to eliminate entrapped air.
   d. Prior to testing, ensure adequate thrust protection is in place and joints are properly installed.
   e. Prior to testing ensure that the line is clean and free of dirt and debris.
   f. For PVC and thermoplastic pipe, follow preparation and procedures described in Section 7 of ANSI/AWWA Standard C605. Test pressure & duration shall be 150 psi for 2 hours for water mains & 100 psi for 2 hours for force mains, unless noted otherwise.
   g. For ductile iron piping, follow preparation & procedures described in AWWA C600. Test pressure shall be as specified and duration shall be for 2 hours.
   h. For HDPE pipe, follow preparation and procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize shall not exceed 8 hours. If re-testing of a test section or pipeline is required, at least 8 hours shall elapse between tests. HDPE pipe test pressure and duration shall be 150 psi for 4-hour expansion period and 140 psi for the 1-hour test.
3. Test Procedure:
   a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
   b. Expel air from pipe as required by venting through air release valves, blow-offs, or special taps at high points in line. Obtain approval of Town / Engineer prior to tapping pipe for expelling air.
   c. During the test, examine all exposed pipe, fittings, valves and appurtenances for leakage. Make repairs to eliminate visible leakage.

d. For DIP and PVC Pressure Pipe

1) Add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
2) Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
3) Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure.
4) Pump from test container to maintain test pressure. Measure volume of water pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.

e. For HDPE Pressure Pipe

1) After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for four hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
2) Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
3) Timed Test Period: After four hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for three hours, indicating no leakage.
4) If no visible leakage is observed and pressure remains within 5% of the original test pressure for one hour, a passing test is indicated.

Makeup Water Allowances:

4. The allowable makeup water allowance is the maximum amount of water that is added into a pipeline undergoing hydrostatic pressure testing. The allowable leakage rates for the various pipe materials and joints are listed below.
5. No Makeup Water: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.
6. Makeup Water shall be less than the allowable amounts specified in AWWA C600 for ductile iron pipe or AWWA C605 for PVC pipe, and less than that determined by the following formula:

$$L = \frac{S*D*(\text{Square Root of } P)}{148{,}000}$$

L = allowable leakage, gallons per hour
S = length of pipe tested, feet
D = nominal diameter of pipe, inches
P = average test pressure during leakage test, psi

7. Observed leaks shall be repaired regardless of leakage measurements.
8. Any damaged or defective pipes, fittings, valves, or joints should be repaired and the pressure test repeated until satisfactory results are obtained, at no additional cost to the Town.

F. Tracer Wire:

1. Any tracer wire installed shall be tested for continuity in the presence of a Town Authorized Representative. Any wire found not to be continuous shall be repaired or replaced.

5.14 **Cleanup**

A. The Contractor shall maintain the site of work, in a neat and clean condition at all times and shall not allow surplus construction materials, tools, rubbish, excess soil and other foreign matter to accumulate in a nuisance fashion and/or hazardous or unsightly manner. The timely disposition or disposal from the site of any such item shall be the complete responsibility of the Contractor. The Contractor shall follow the requirements of IDEM Rule 5 at all times.

B. Final acceptance will not be made until after all cleanup, site work including restoration of all fences, lawns, landscaping, mailboxes, curbs, drives, poles, signs, sidewalks, property monument replacement, pavement replacement, repair work and all other miscellaneous items disturbed during construction have been completed to a condition equal to that before construction began, and to the satisfaction of the Town and/or any other public body that may have jurisdiction.

5.15 **Guarantee**

A. In general all materials, labor, equipment, miscellaneous accessories and their installation shall be guaranteed to be free from all defects for a period of one year from the date of start-up and continuous use by the Town. Any defects found during this one year period shall be repaired or replaced at no cost to the Town and any such defect that has been repaired or replaced shall thenceforth be guaranteed for an additional twelve months from the date of such repair or replacement.

B. The Contractor shall assume complete responsibility for the guarantee of all facets of construction and is hereby cautioned that individual manufacturer’s guarantees of equipment or other appurtenances will not be recognized unless they exceed the requirements of the previous paragraph.

C. The required lubrication, start-up and adjustment of equipment and other appurtenances shall be performed at the appropriate time by or under the direct supervision of the Contractor and the manufacturer's representative with all equipment and appurtenances left in proper working order for use by the Town.

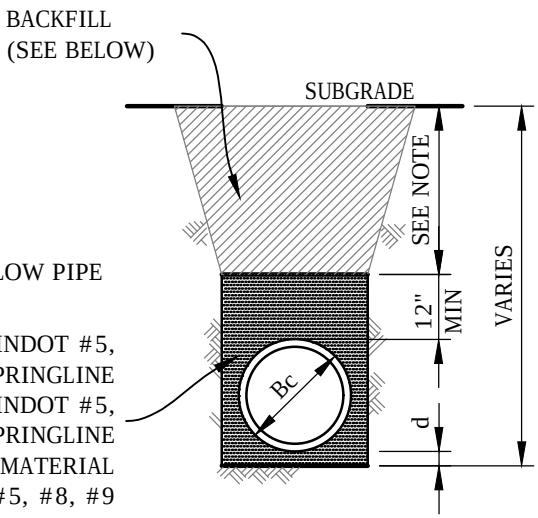
D. The Contractor shall be responsible for assembling from each manufacturer of equipment supplied on the project, shop drawings, specifications, and operations and maintenance (O&M) instructions into one or more manuals and furnish the Town with three (3) hard copies plus one (1) PDF copy of each manual.

BEDDING SPECIFICATIONS

1. FOR ROCK OR OTHER NON-COMPRESSIBLE MATERIAL, THE TRENCH SHALL BE OVER EXCAVATED TO PROVIDE A MINIMUM OF 6" MINIMUM CLEARANCE TO THE PIPE AND REFILLED WITH BEDDING MATERIAL.

2.

DEPTH OF BEDDING MATERIAL BELOW PIPE	
D	d(Min.)
LESS THAN 36"	4"
36" & LARGER	Bc / 8



LEGEND

Bc = OUTSIDE DIA. OF PIPE
D = INSIDE DIA. OF PIPE
d = BEDDING MATERIAL BELOW PIPE BELL

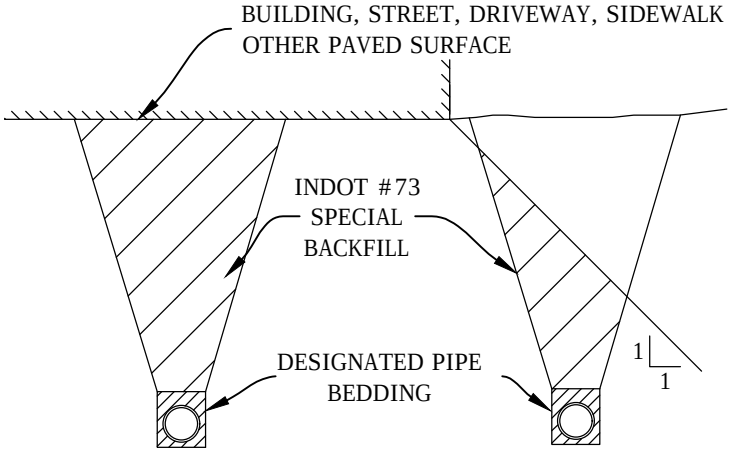
FLEXIBLE PIPE: COMPACTED STONE INDOT #5, #8, D-SAND, PEA GRAVEL BELOW SPRINGLINE AND COMPACTED GRANULAR BEDDING INDOT #5, #8, #9, D-SAND, PEA GRAVEL ABOVE SPRINGLINE

RIGID PIPE: COMPACTED GRANULAR MATERIAL INDOT #5, #8, #9

BACKFILL SPECIFICATIONS

1. BACKFILL UNDER PAVED AREAS SHALL BE INDOT #73. INFLUENCE ZONE SHALL EXTEND AT A 1:1 SLOPE FROM ABOVE ITEM. COMPACTION SHALL MEET OR EXCEED 95% OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557.

2. BACKFILL WITHIN LAWN AREAS AND OUT OF THE INFLUENCE OF: BUILDING STRUCTURES, AND PAVED AREAS, SHALL BE STANDARD BACKFILL. STANDARD BACKFILL SHALL BE FREE OF: ROCK AND GRAVEL LARGER THAN 3" IN ANY DIMENSION, DEBRIS, WASTE, FROZEN MATERIALS, VEGETATION, AND OTHER DELETERIOUS MATERIAL ACCORDING TO ASTM D 2487. COMPACTION SHALL MEET OR EXCEED 90% OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO ASTM D 1557.



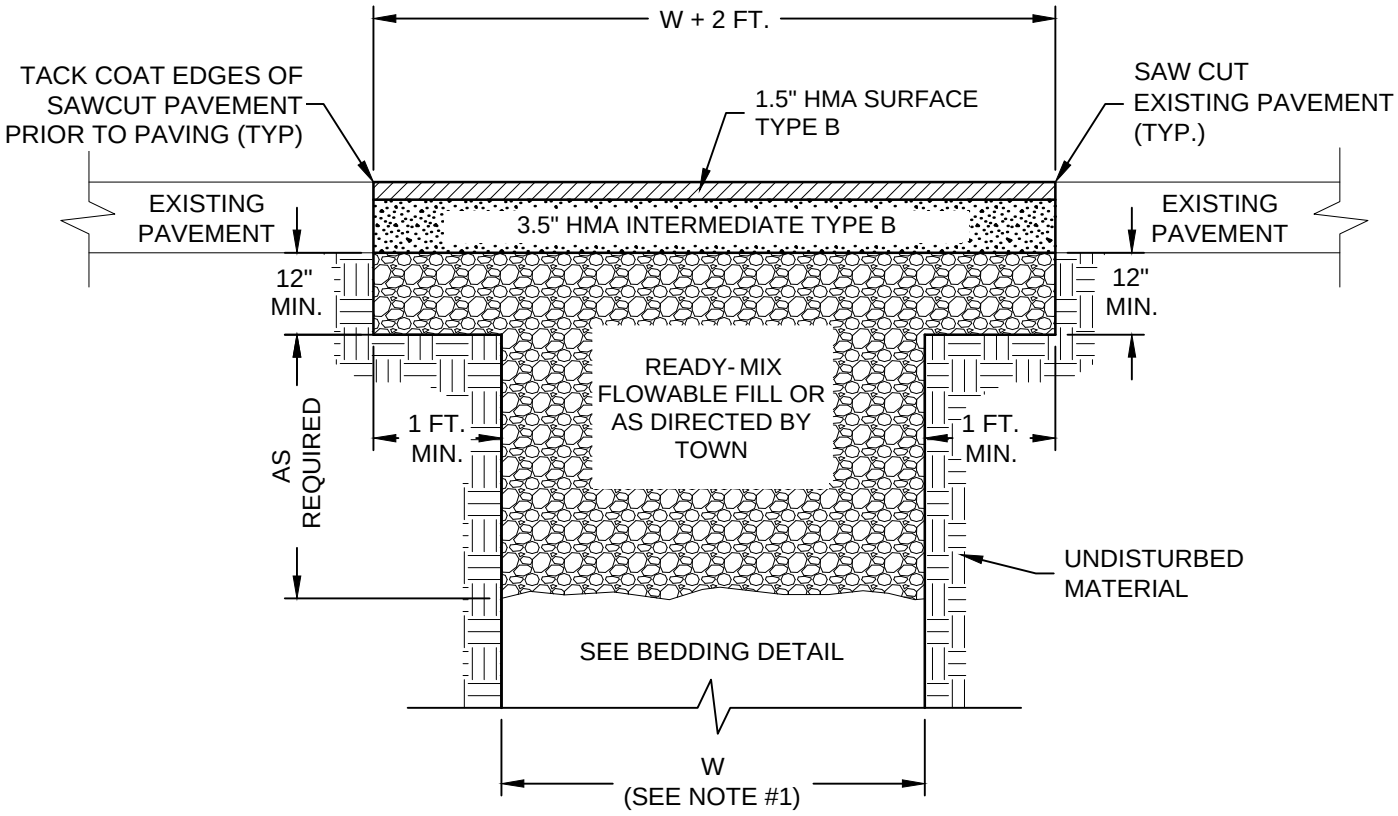
INFLUENCE LINE

SCALE : N.T.S.

NOTES:

1. MINIMUM COVER - STORMWATER 3', GRAVITY SANITARY MAINS 4', SANITARY LATERALS 3', WATER & FORCE MAINS 5'.
2. FLEXIBLE PIPE - PVC, HDPE, DIP, & CMP ARE CONSIDERED FLEXIBLE PIPES.
3. RIGID PIPE - RCP IS CONSIDERED RIGID PIPE.

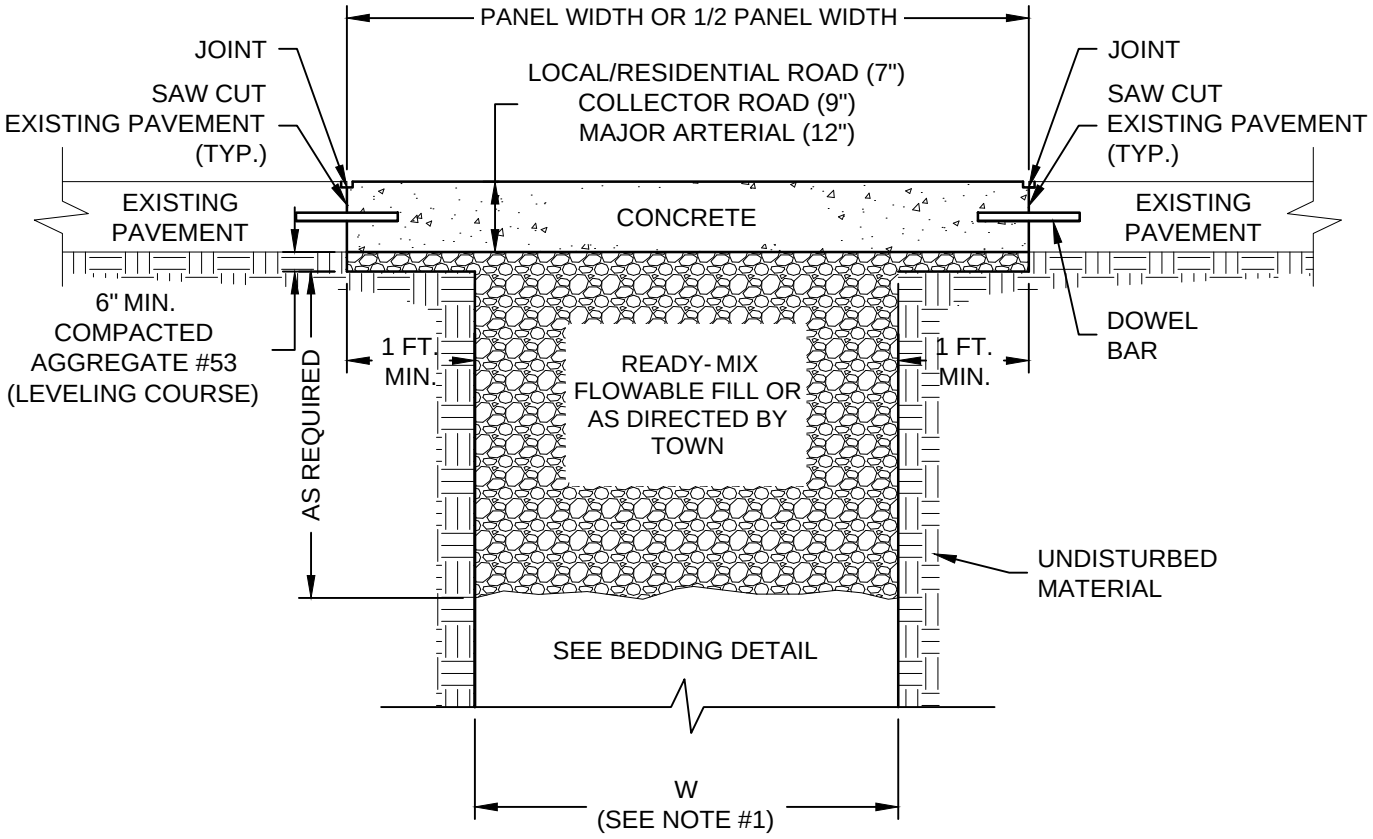
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	BF-01	PIPE TRENCH DETAIL	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED



NOTES:

1. MAXIMUM PAID WIDTH OF TRENCH (W) SHALL BE PER SPECIFICATIONS.
2. NEW SURFACE SHALL BE SLOPED TO MATCH EXISTING PAVEMENT.
3. FINAL ASPHALT CROSS SECTION SUBJECT TO REVIEW & MODIFICATION BY TOWN.

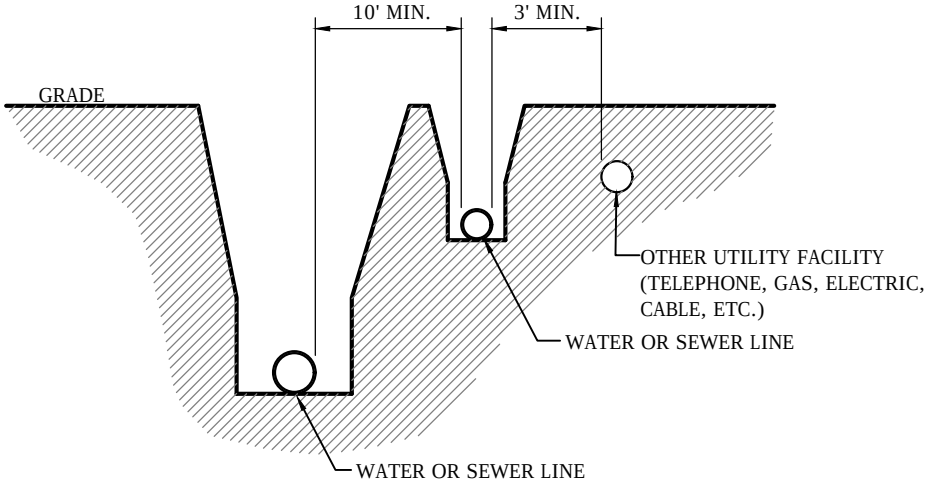
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	BF-02	ASPHALT PATCH OVER UTILITY TRENCH
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



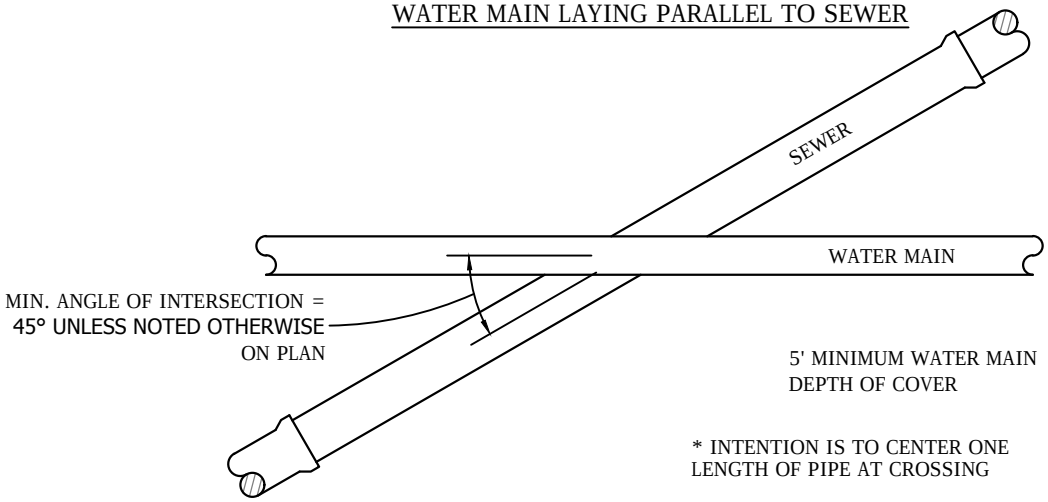
NOTES:

1. MAXIMUM PAID WIDTH OF TRENCH (W) SHALL BE PER SPECIFICATIONS.
2. NEW SURFACE SHALL BE SLOPED TO MATCH EXISTING PAVEMENT.

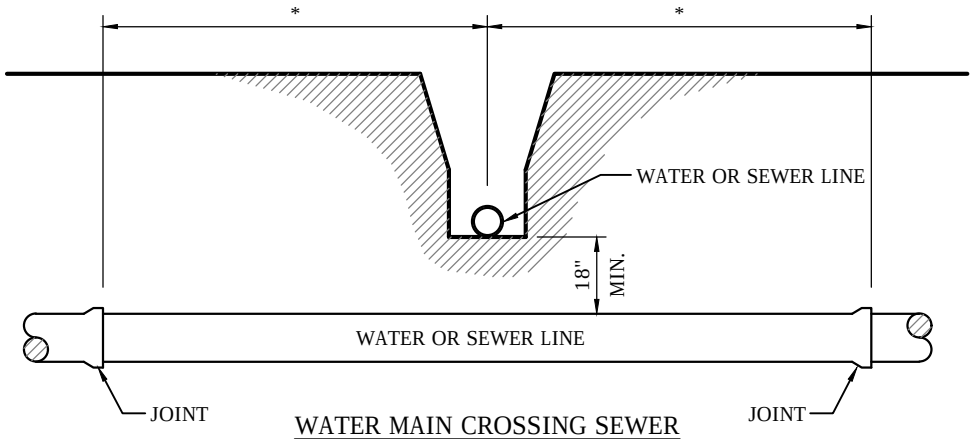
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	BF-03	CONCRETE PATCH OVER UTILITY TRENCH
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED: SCALE: NONE



WATER MAIN LAYING PARALLEL TO SEWER



* INTENTION IS TO CENTER ONE LENGTH OF PIPE AT CROSSING

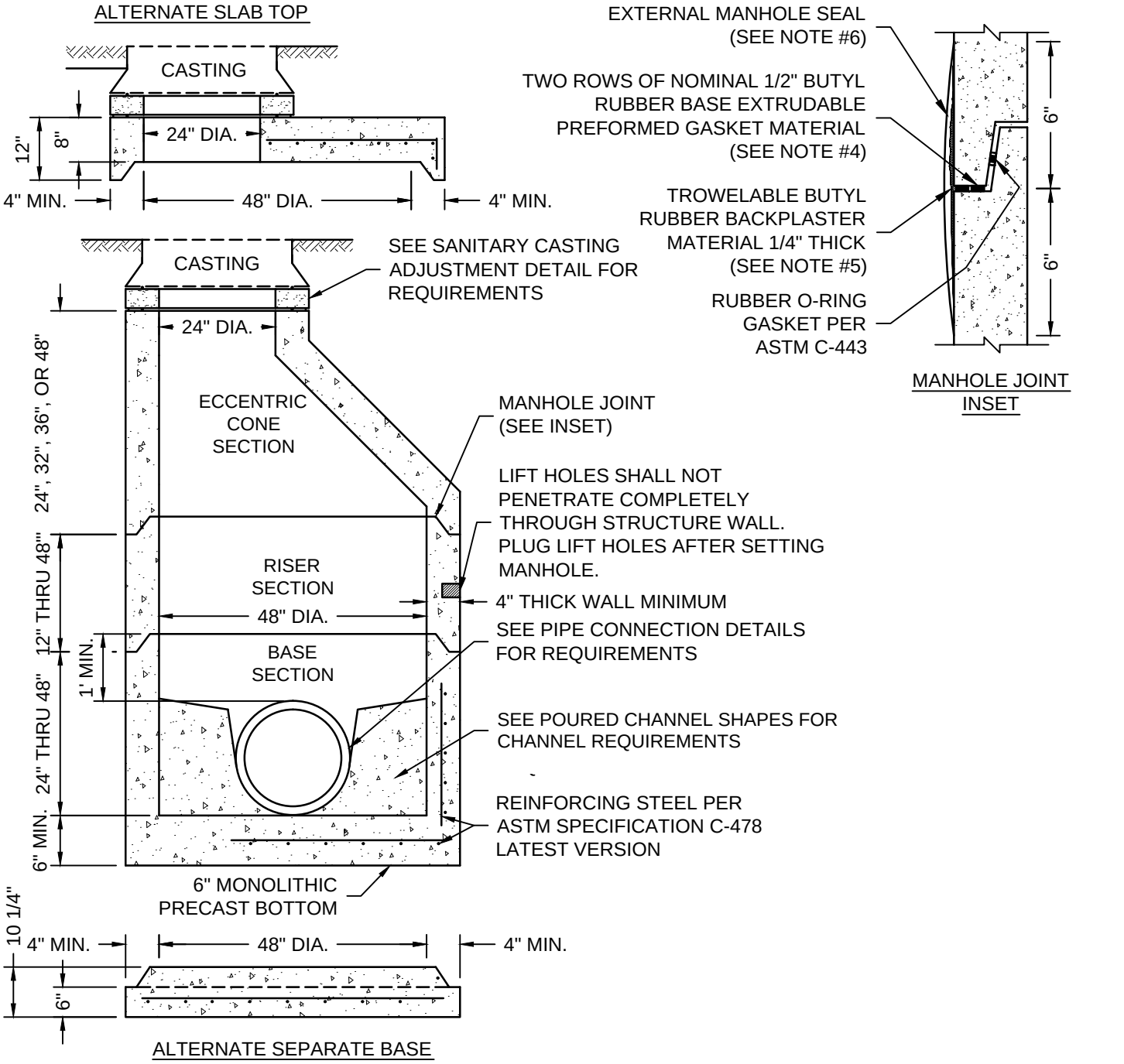


WATER MAIN CROSSING SEWER

NOTES:

1. WATER MAIN SHALL NOT BE LOCATED IN THE SAME TRENCH AS SANITARY SEWERS.
2. SEPARATION OF 3FT. HORIZONTAL WITH ANY UTILITY REQUIRED.
3. 5' MINIMUM DEPTH OF COVER ON WATER MAIN.
4. PREFERENCE IS FOR THE WATER MAIN TO BE LOCATED ABOVE ALL SEWERS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-01	SEWER & WATER MAIN SEPARATION
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED

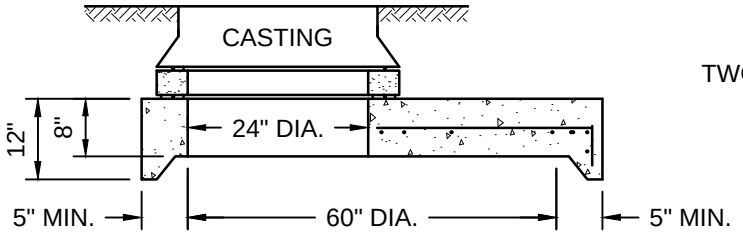


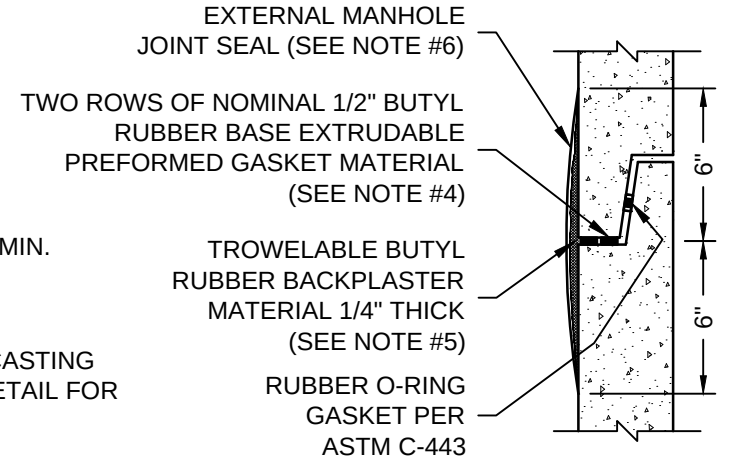
NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED FRACTURED FACE STONE, 6" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. APPLY TROWELABLE BUTYL RUBBER BACK PLASTER MATERIAL 1/4" THICK (WHEN DRY) FROM 6" ABOVE TO 6" BELOW JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACUTRED BY PRESS-SEAL GASKET CORP.
6. EXTERNAL MANHOLE JOINT SEAL SHALL CONSIST OF A SHEET OF PLASTIC VISQUEEN.

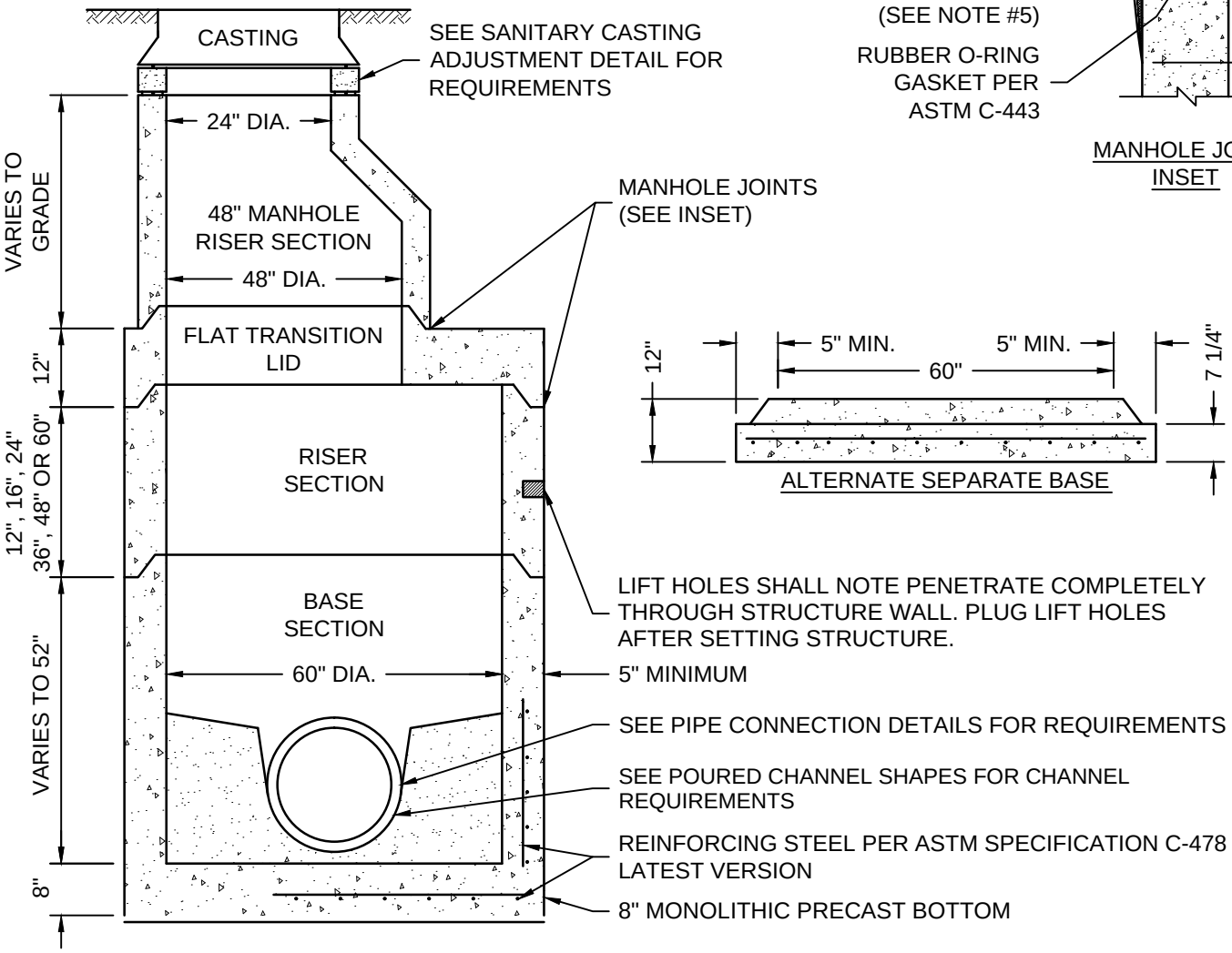
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-02	48" SANITARY MANHOLE
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE

ALTERNATE SLAB TOP





MANHOLE JOINT INSET

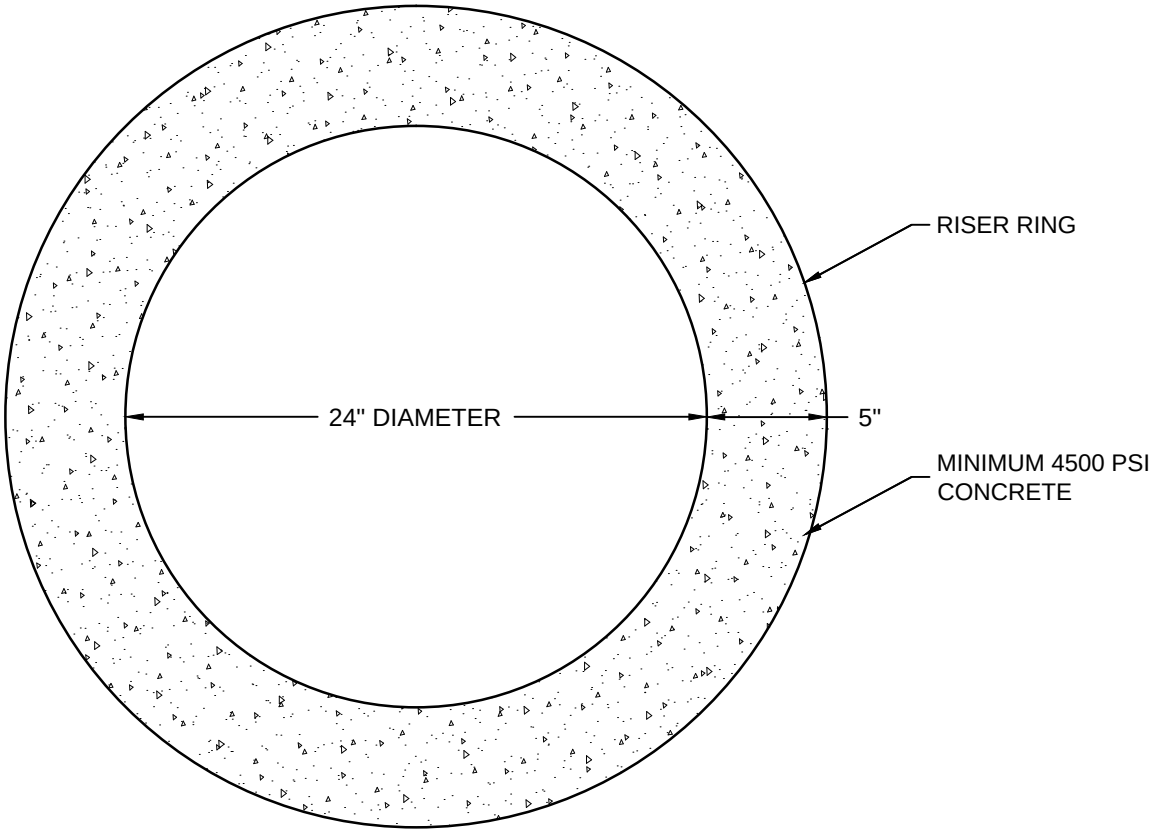


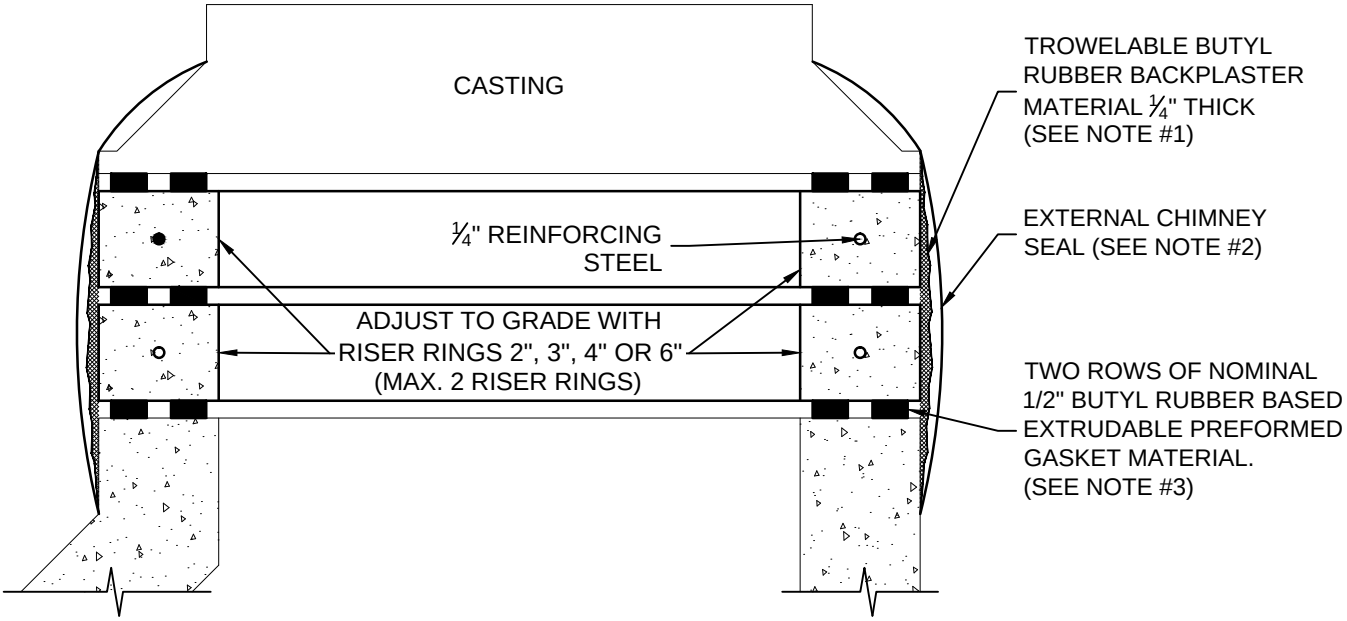
ALTERNATE SEPARATE BASE

NOTES:

1. CAST IN PLACE BASE ONLY PERMITTED WITH WRITTEN APPROVAL OF TOWN.
2. THE BASE SHALL BE PLACED ON COMPACTED FRACTURED FACE STONE, 6" MINIMUM.
3. THE INSIDE WALL DISTANCE BETWEEN OPENINGS SHALL BE A MINIMUM OF 6".
4. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.
5. APPLY TROWELABLE BUTYL RUBBER BACK PLASTER MATERIAL 1/4" THICK (WHEN DRY) FROM 6" ABOVE TO 6" BELOW JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACUTRED BY PRESS-SEAL GASKET CORP.
6. EXTERNAL MANHOLE JOINT SEAL SHALL CONSIST OF A SHEET OF PLASTIC VISQUEEN.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-03	60" SANITARY MANHOLE
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE

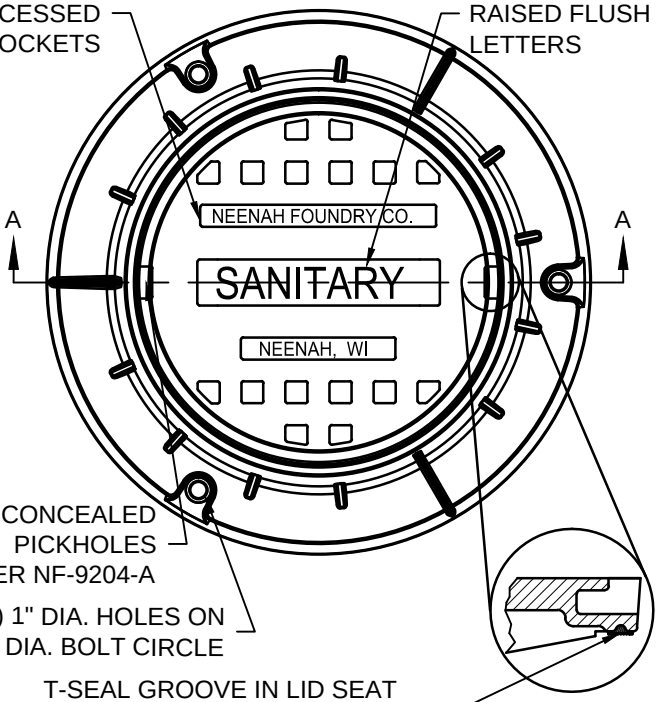




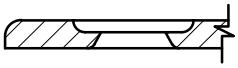
NOTES:

1. APPLY TROWELABLE BUTYL RUBBER BACKPLASTER MATERIAL 1/4" THICK (WHEN DRY) OVER RISER RINGS FROM 6" ABOVE TO 6" BELOW RISER RING JOINTS. USE TROWELABLE EZ-STICK #3, AS MANUFACTURED BY PRESS-SEAL GASKET CORP.
2. EXTERNAL CHIMNEY SEAL SHALL CONSIST OF A HEAT- SHRINKING WRAP- AROUND SLEEVE (WRAPIDSEAL AS MANUFACTURERD BY CANUSA) OR EXTERNAL CHIMNEY SEAL (AS MANUFACTURED BY CRETEX).
3. USE RU 106 RUB'RNEK LTM AS MANUFACTURED BY HENRY CO., KENT-SEAL NO. 2 AS MANUFACTURED BY HAMILTON-KENT OR EZ-STICK BUTYL-RUBBER-BASED PREFORMED FLEXIBLE SEALANT AS MANUFACTURED BY PRESS-SEAL.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-04	SANITARY CASTING ADJUSTMENT	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



PICKHOLE DETAIL

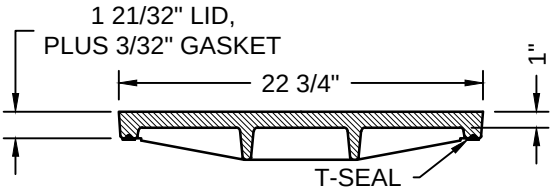


ANCHOR HOLE DETAIL

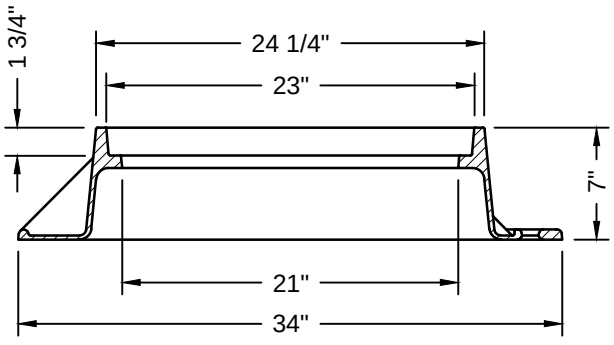
NOTES:

1. ASTM A48-83 CLASS NO. 35
2. ALL BEARING SURFACES TO BE MACHINED

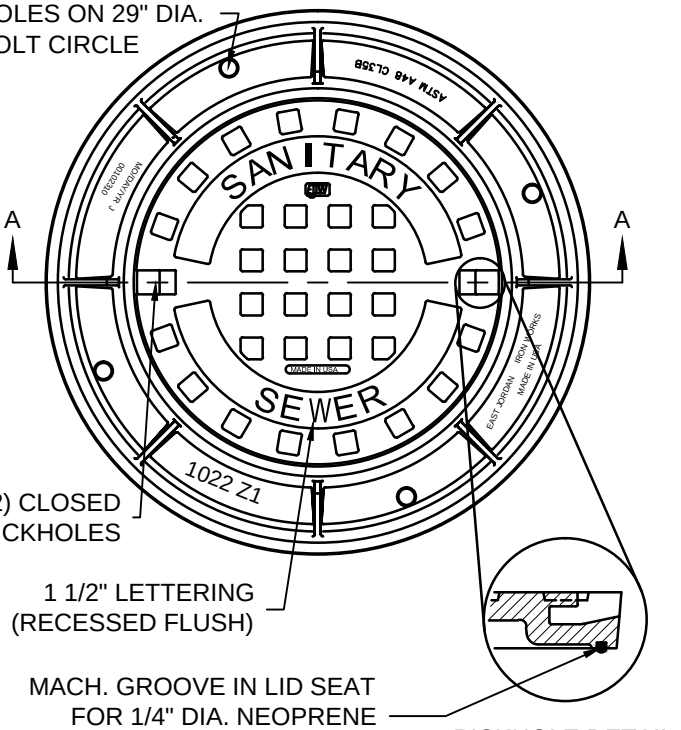
FRAME AND SOLID LID
NEENAH R-1772 W/"SANITARY" LETTERED, SOLID LID (SANITARY APPLICATION ONLY)



LID SECTION A-A



FRAME SECTION A-A

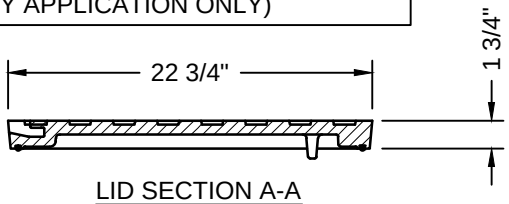


PICKHOLE DETAIL

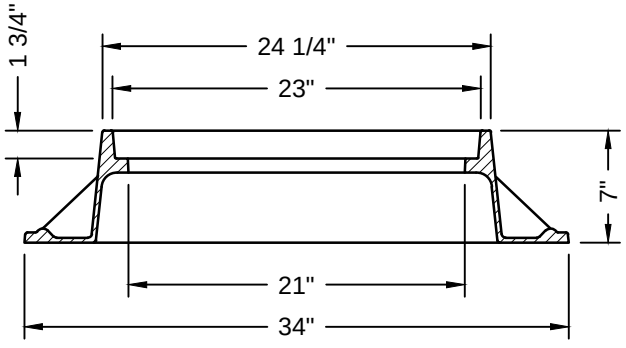
NOTES:

1. ASTM A48-83 CLASS NO. 35
2. ALL BEARING SURFACES TO BE MACHINED

FRAME AND SOLID LID
EAST JORDAN 1022Z1 W/1020AHDGS "SANITARY SEWER" LETTERED, SOLID LID (SANITARY APPLICATION ONLY)

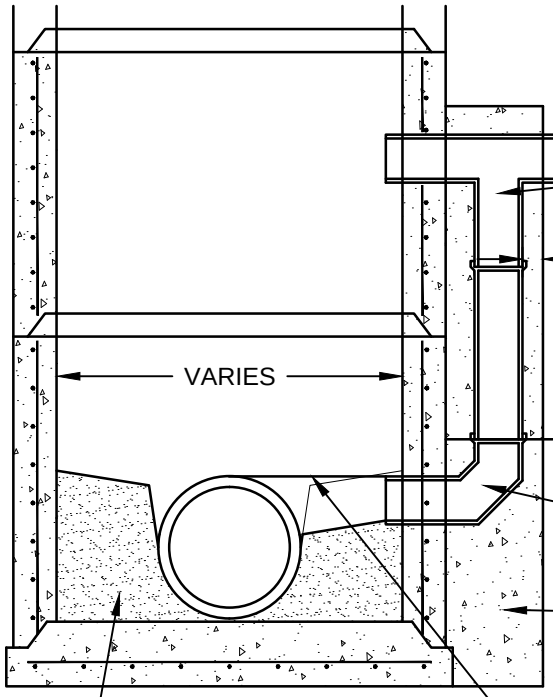


LID SECTION A-A



FRAME SECTION A-A

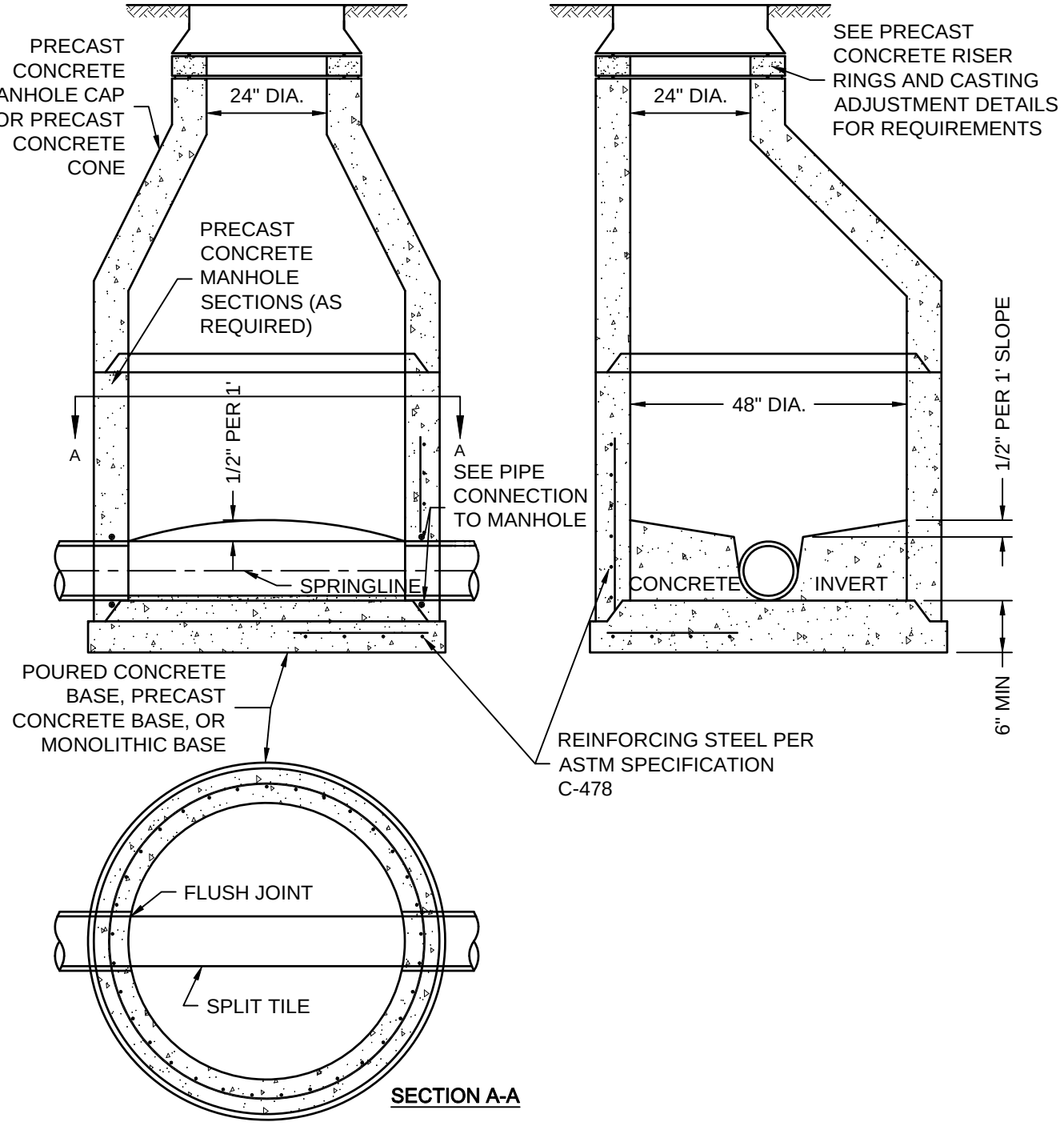
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-05	24" SANITARY CASTING
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



NOTES:

1. DROP PIPE SHALL BE A MINIMUM OF 8" FOR 8" TO 12" DIAMETER MAINLINE PIPE AND 12" DROP PIPE FOR ALL LARGER MAINLINE PIPES UNLESS OTHERWISE SPECIFIED.
2. GENERAL CONSTRUCTION REQUIREMENTS SAME AS STANDARD 48" MANHOLE.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-06	OUTSIDE DROP CONNECTION FOR MANHOLES
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED: / SCALE: NONE



SECTION A-A

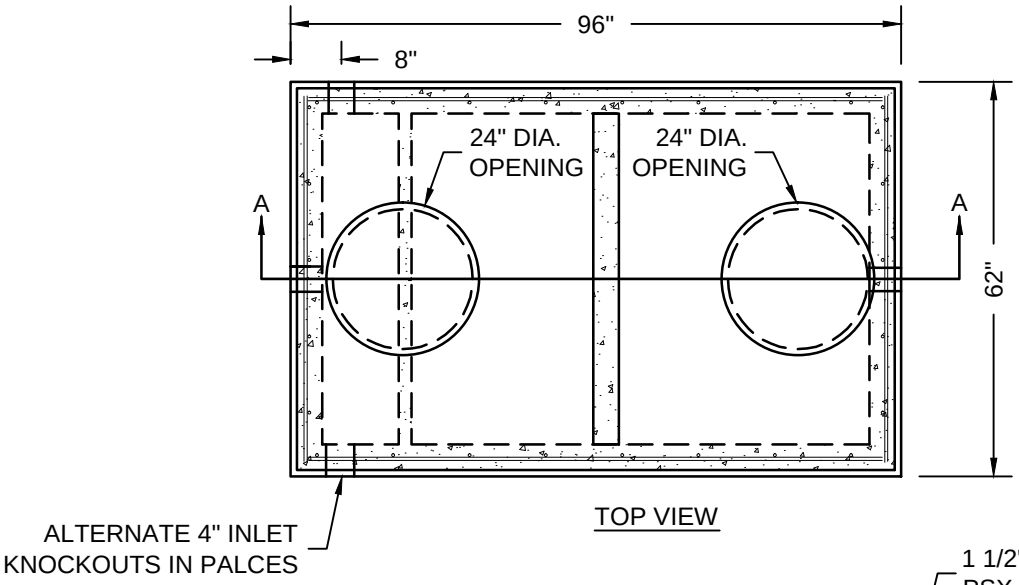
NOTES:

1. MAXIMUM FLOW LIMIT FOR A NON-METERED CONTROL MANHOLE IS 50,000 G.P.D.

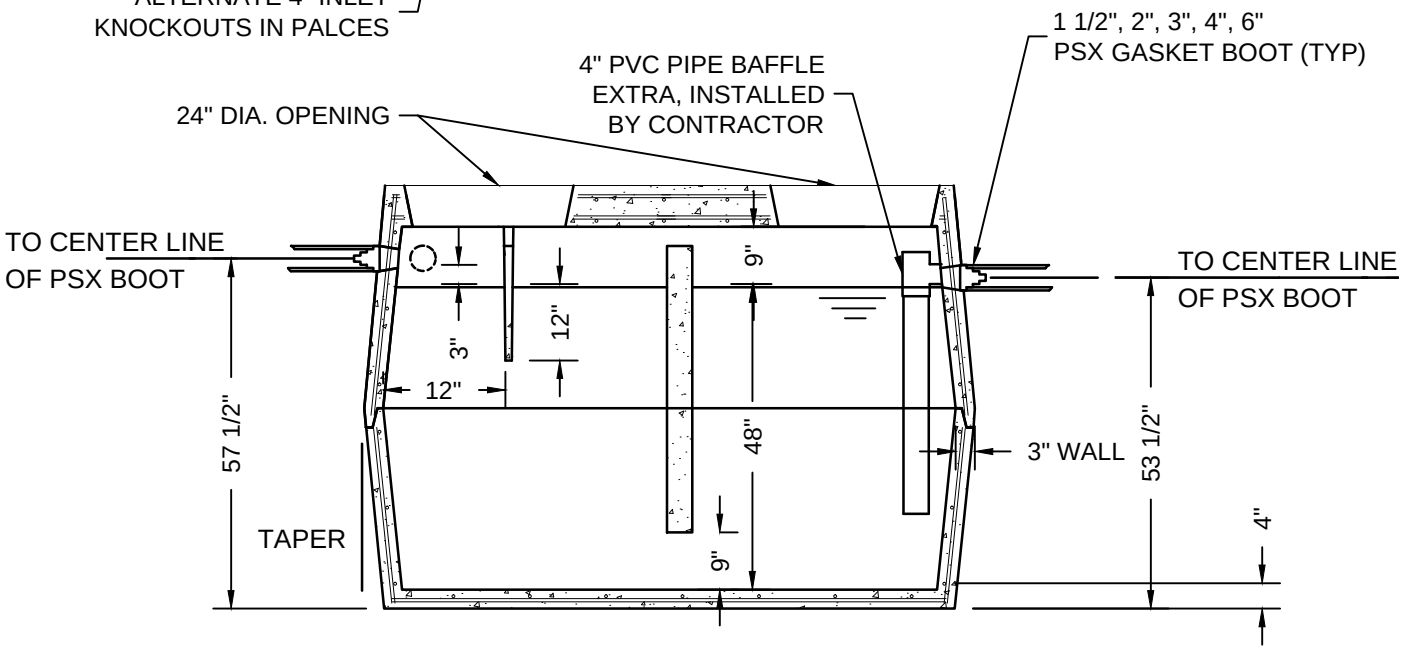
GENERAL CONSTRUCTION REQUIREMENTS:

1. ALL PRECAST MANHOLES TO BE CONSTRUCTED PER ASTM C-478.
2. PIPE SHALL BE LAID STRAIGHT THROUGH WITH SPLIT TILE OR BROKEN OUT INSIDE TO SMOOTH FINISH.
3. SHOP DRAWINGS SHALL BE APPROVED PRIOR TO CONSTRUCTION.
4. ALL INSIDE JOINTS OF MANHOLE COMPONENTS SHALL BE SMOOTHED WITH MORTAR.
5. MINIMUM DIAMETER OF THROUGH PIPE SHALL BE 6".
6. MANHOLE CONSTRUCTION SHALL COMPLY WITH 48" SANITARY MANHOLE DETAIL.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-07	CONTROL MANHOLE
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



TOP VIEW

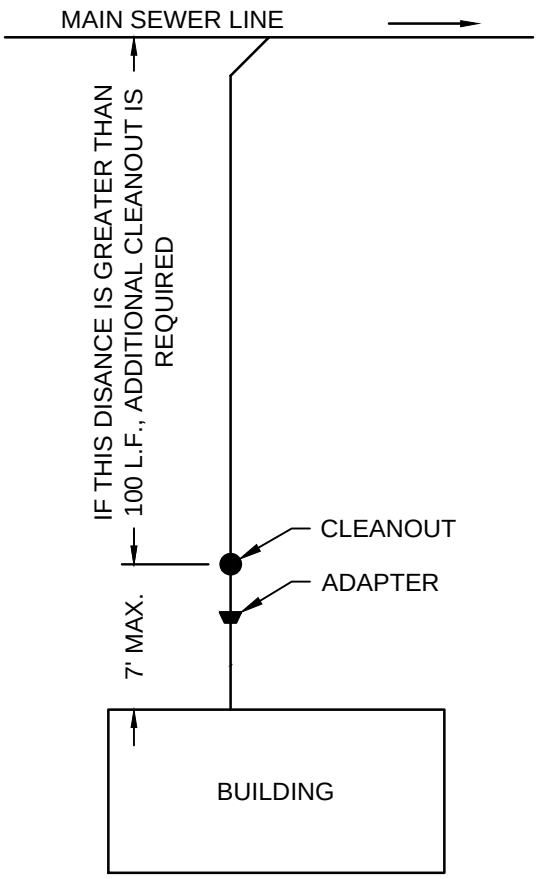


SECTION A-A

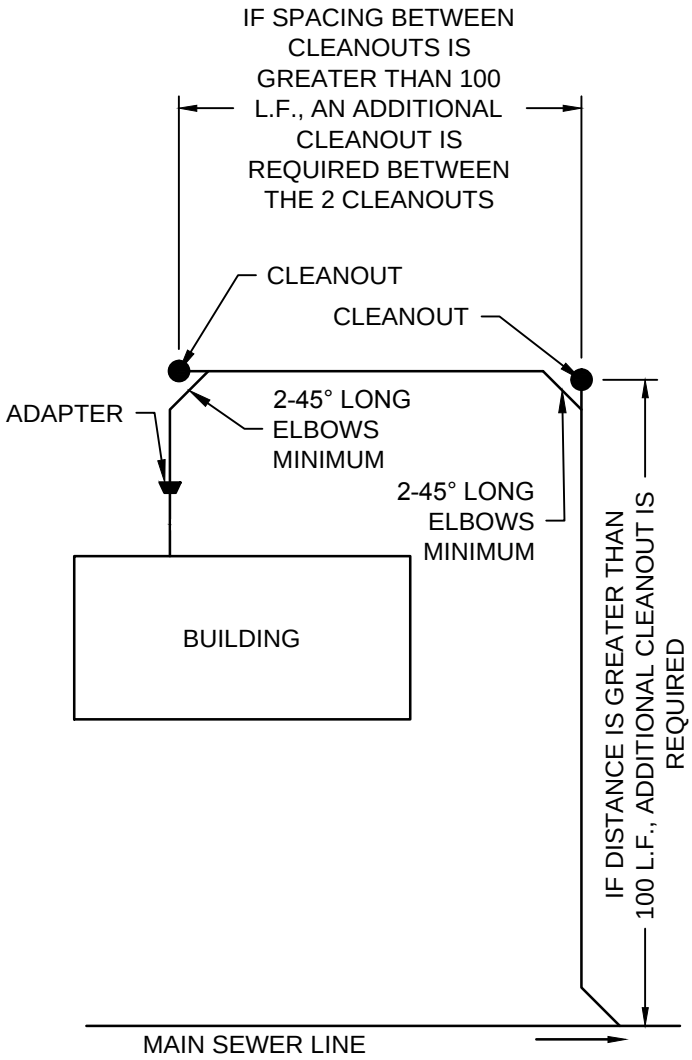
NOTES:

1. OPTIONAL TANK RISERS SHOULD BE ORDERED TO GRADE.
2. MINIMUM 4500 PSI AT 28 DAYS CONCRETE.
3. REINFORCING BARS SHALL CONFORM TO ASTM A-615 GRADE 60 STEEL.
4. ALL REINFORCING BARS SHALL BE CUT AND FORMED TO THE DIMENSIONAL TOLERANCES SPECIFIED IN ACI-315 OR ACI-318 EXCEPT WHERE NOTED ON DRAWINGS.
5. ALL BARS SHALL BE BENT COLD. BARS WITH KINKS AND BENDS NOT INDICATED SHALL NOT BE USED. HEATING AND REBENDING OF BARS IS NOT PERMITTED.
6. REINFORCING STEEL SHALL BE #4 REBAR AT 12" O.C. BOTH WAYS TIED TO 6X6 10/10 WELDED WIRE MESH. TOP OF GREASE TRAP TO HAVE DOUBLE LAYER OF STEEL.
7. EARTH COVER: 2'-0" MINIMUM UP TO 5'-0" MAXIMUM. SIZE PAD ACCORDING TO AMOUNT OF EARTH COVER.
8. DESIGN FOR TRAFFIC LOADING.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-08	1000 GALLON GREASE INTERCEPTOR
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



STRAIGHT CONNECTION

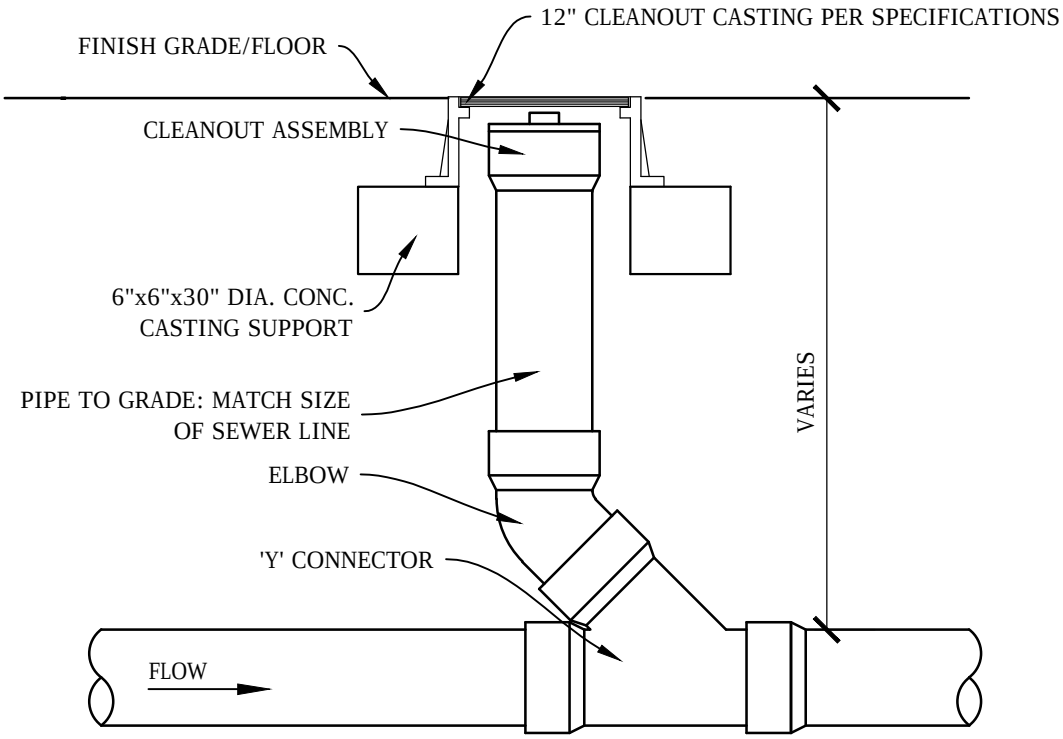


AROUND THE BUILDING CONNECTION

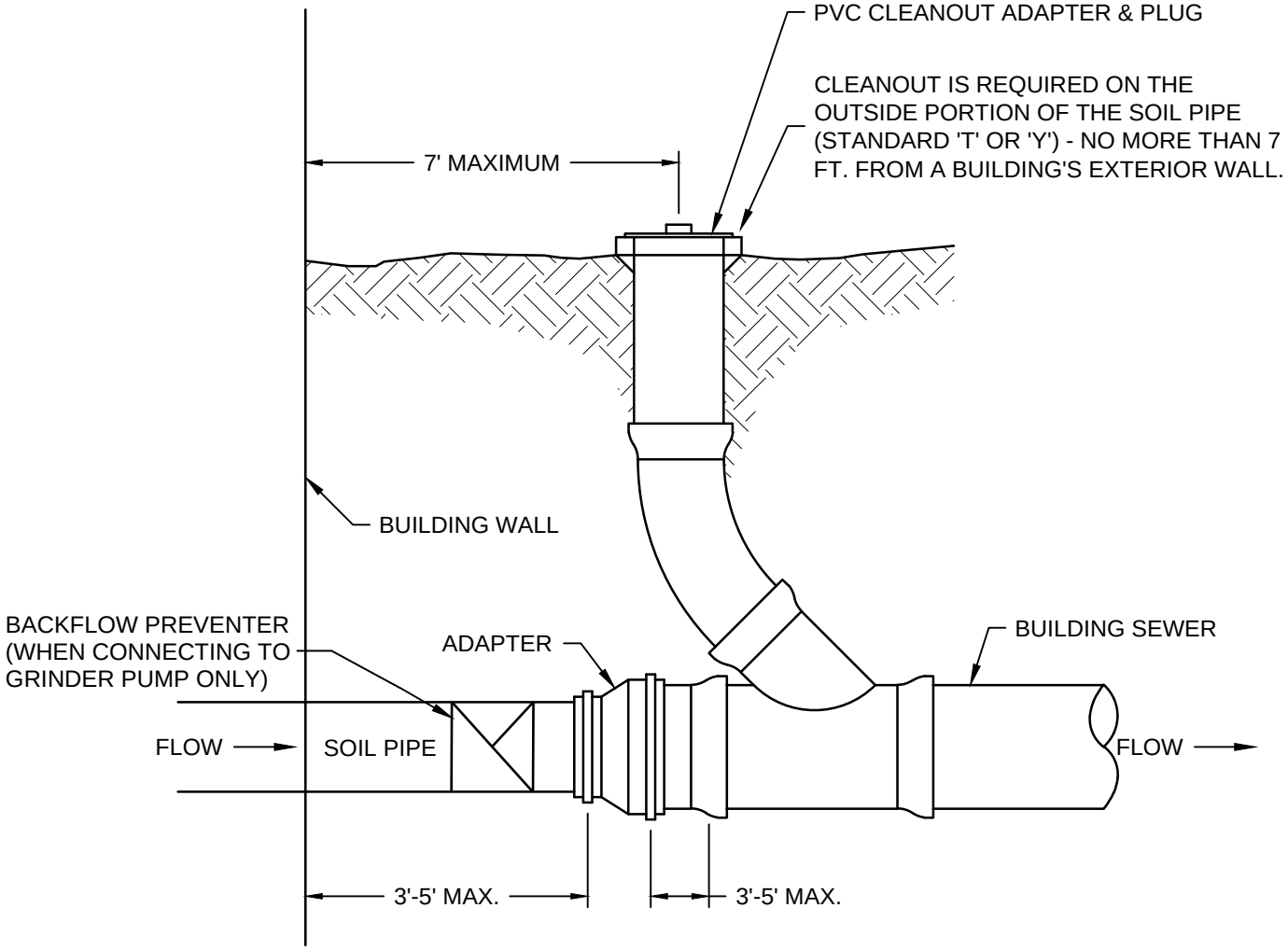
NOTES:

1. MAXIMUM DISTANCE BETWEEN THE EXTERIOR WALL AND THE CLEANOUT WYE SHALL BE 7'.
2. NO 90° ELBOW IS PERMITTED IN BUILDING SEWER. TWO 45° LONG ELBOWS MUST BE USED.
3. MINIMUM SLOPE OF BUILDING SEWER SHALL BE 1% FOR 6" DIAMETER PIPE AND 2% FOR 4" DIAMETER PIPE.
4. MINIMUM SIZE FOR BUILDING SEWER SHALL BE FOUR INCH (4") DIAMETER.
5. BUILDING SEWER LINE SHALL BE INSPECTED AND APPROVED BEFORE EXCAVATION IS BACKFILLED.
6. NO CLEANOUT CAN BE INSTALLED IN A ROAD OR ALLEY RIGHT-OF-WAY OR IN A DEDICATED EASEMENT UNLESS OTHERWISE APPROVED BY THE GOVERNING AGENCY OR DEPARTMENT.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-09	GRAVITY SANITARY LATERAL LAYOUT
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

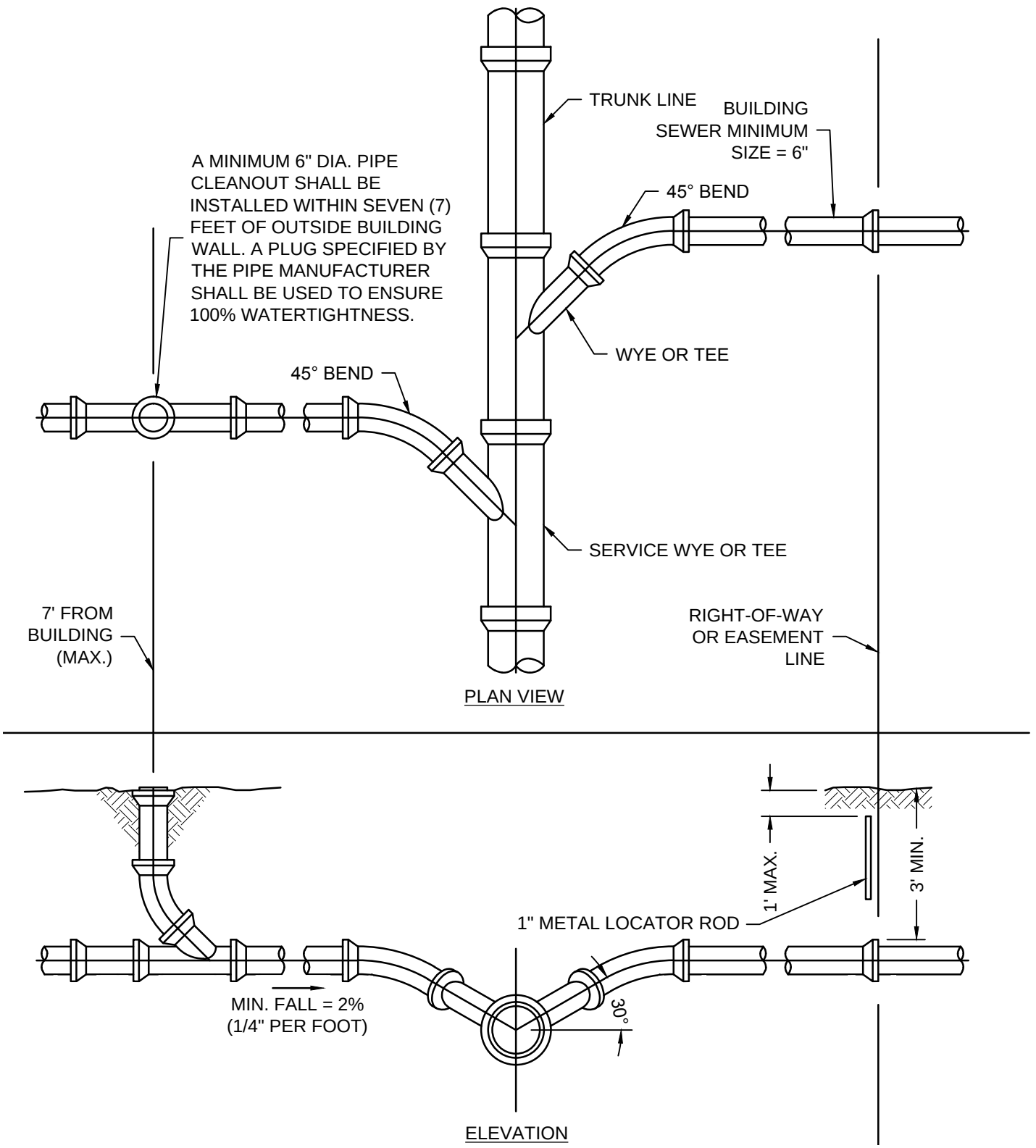


Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-10	GRAVITY SEWER CLEANOUT	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED



Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-11	BUILDING ADAPTER & CLEANOUT	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

LESS THAN 15' DEEP

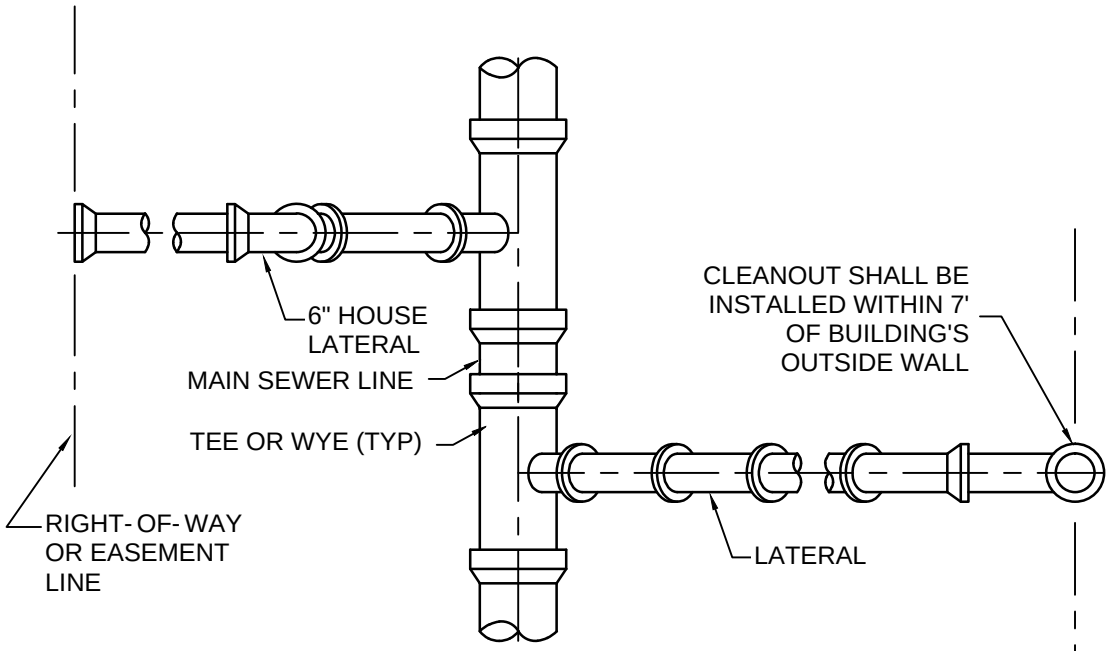


NOTES:

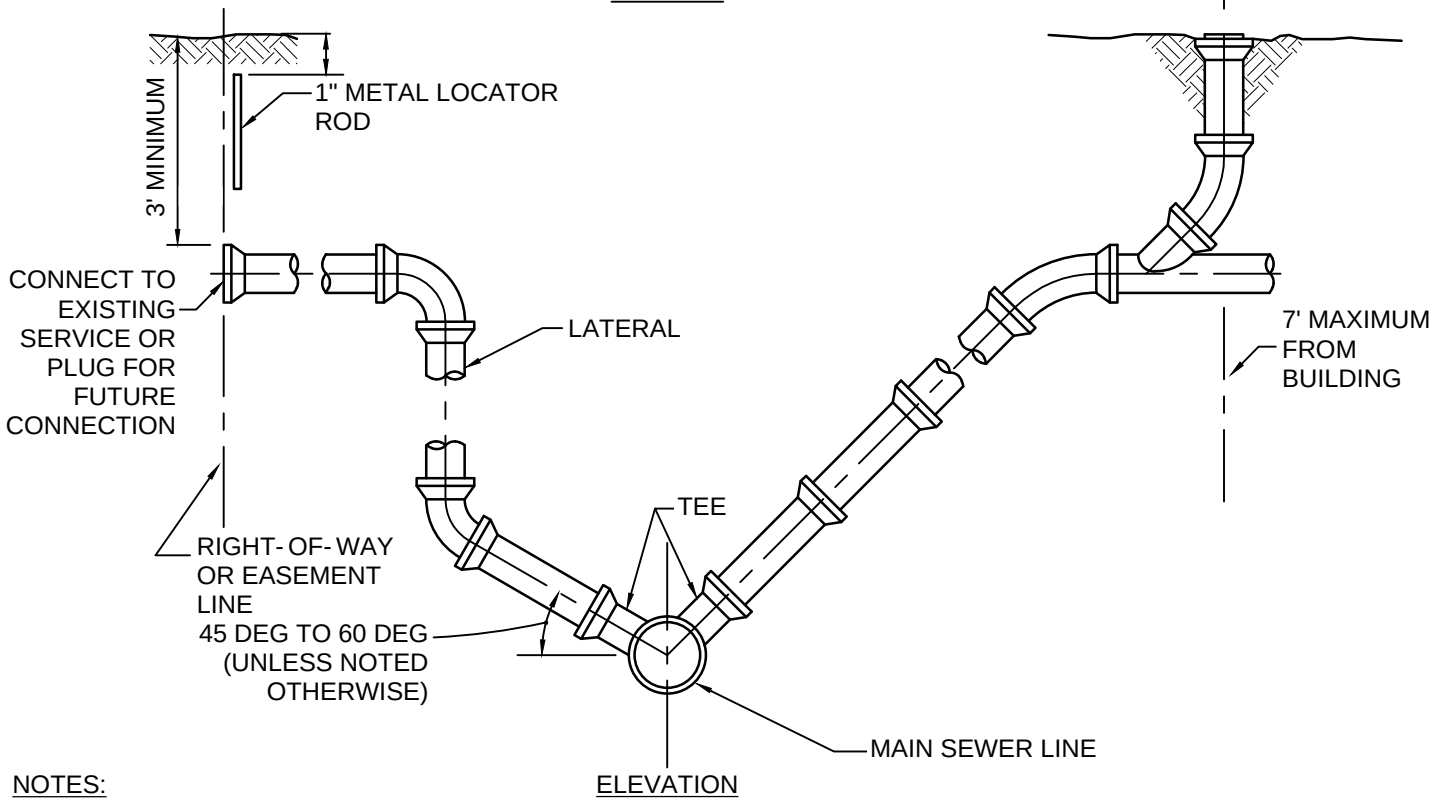
1. COMPACTION OF GRANULAR BACKFILL IS CRITICAL UNDER WYE AND BEND.
2. PROVIDE TRACER WIRE ON LATERALS PER SPECIFICATIONS.
3. PROVIDE WOOD STAKE EXTENDING 18" ABOVE GRADE AT SAME LOCATION AS METAL LOCATOR ROD.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-12	SANITARY LATERAL SHALLOW SERVICE CONNECTION
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE

15' DEEP AND OVER



Plan View

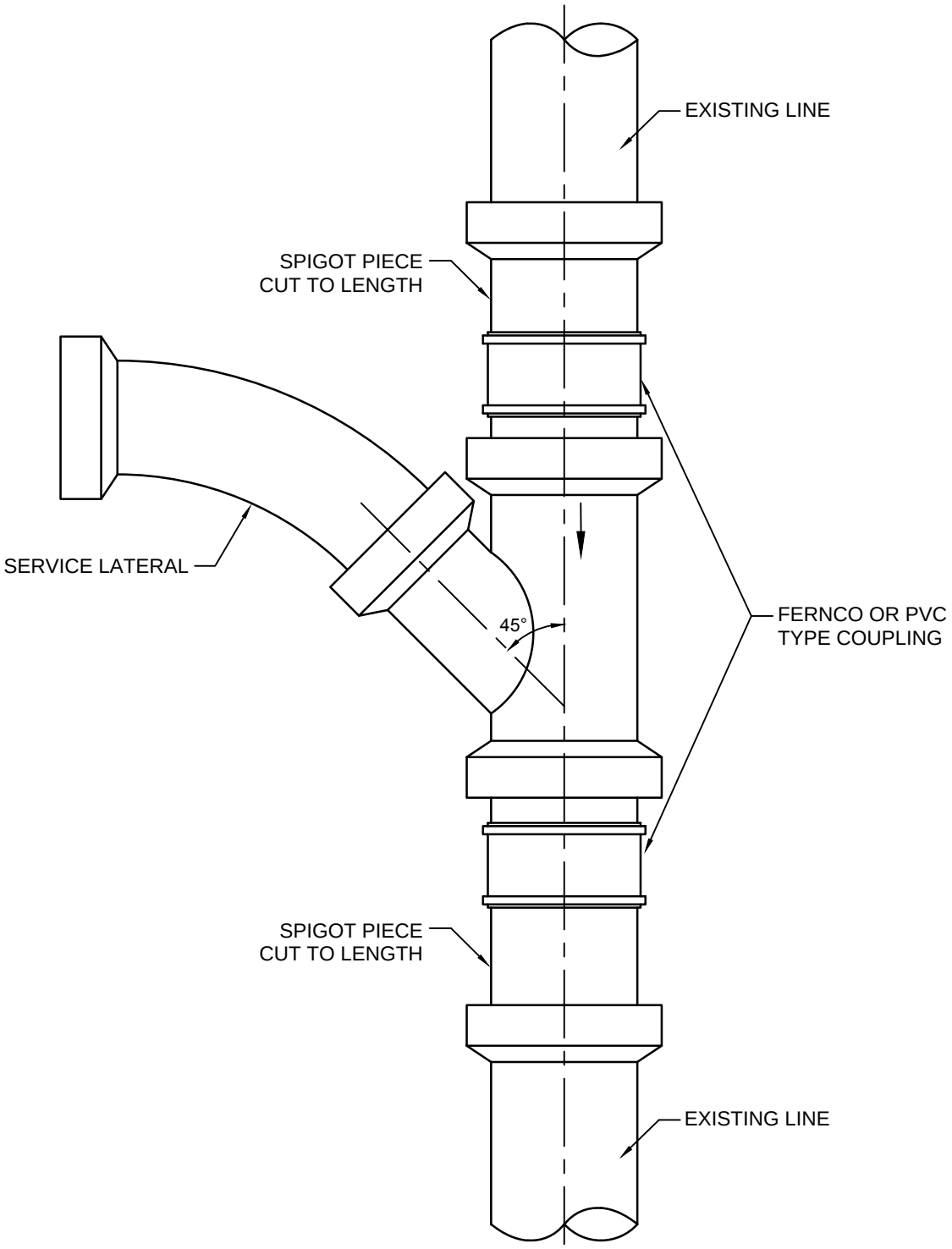


ELEVATION

NOTES:
1. MINIMUM LATERAL SLOPE: 1/4" PER FOOT.
2. PROVIDE TRACER WIRE ON LATERAL PER SPECIFICATIONS.
3. PROVIDE WOOD STAKE EXTENDING 18" ABOVE GRADE AT SAME LOCATION AS METAL LOCATOR ROD.

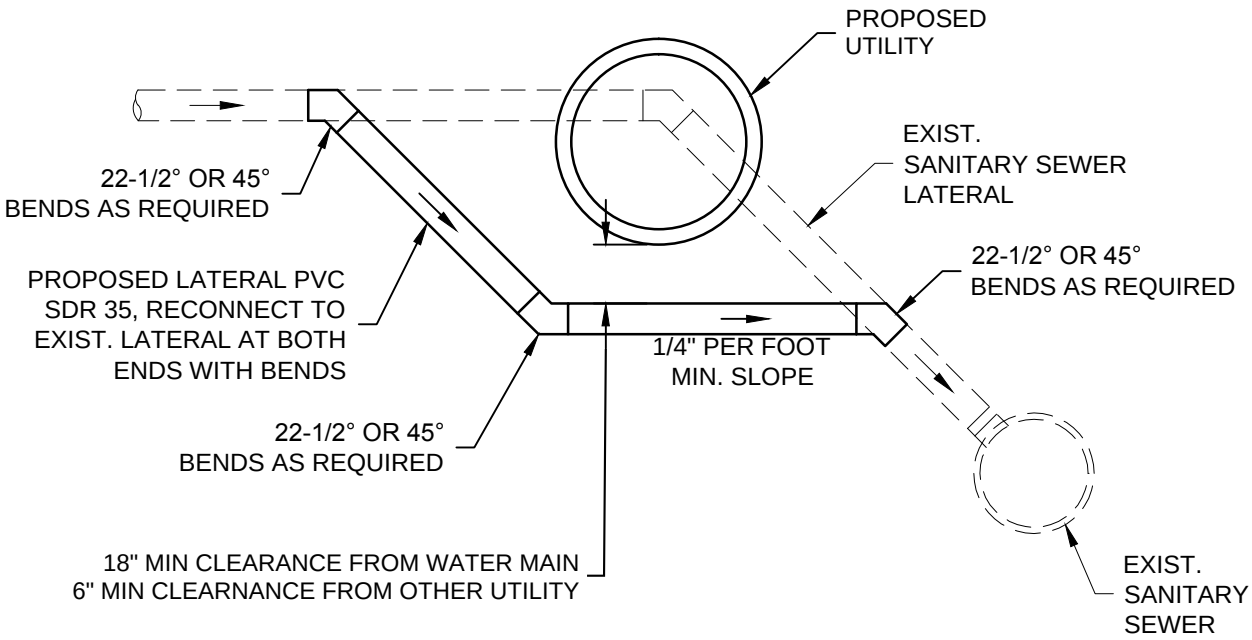
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-13	SANITARY LATERAL DEEP SERVICE CONNECTION
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

PIPES LESS THAN 15"



NOTES:
1. MANUFACTURED WYES OR TEES SHALL BE USED FOR ALL MAINLINE PIPE LESS THAN 15" IN DIAMETER.
2. BYPASS PUMPING BY CONTRACTOR AS REQUIRED WITH TOWN APPROVAL.

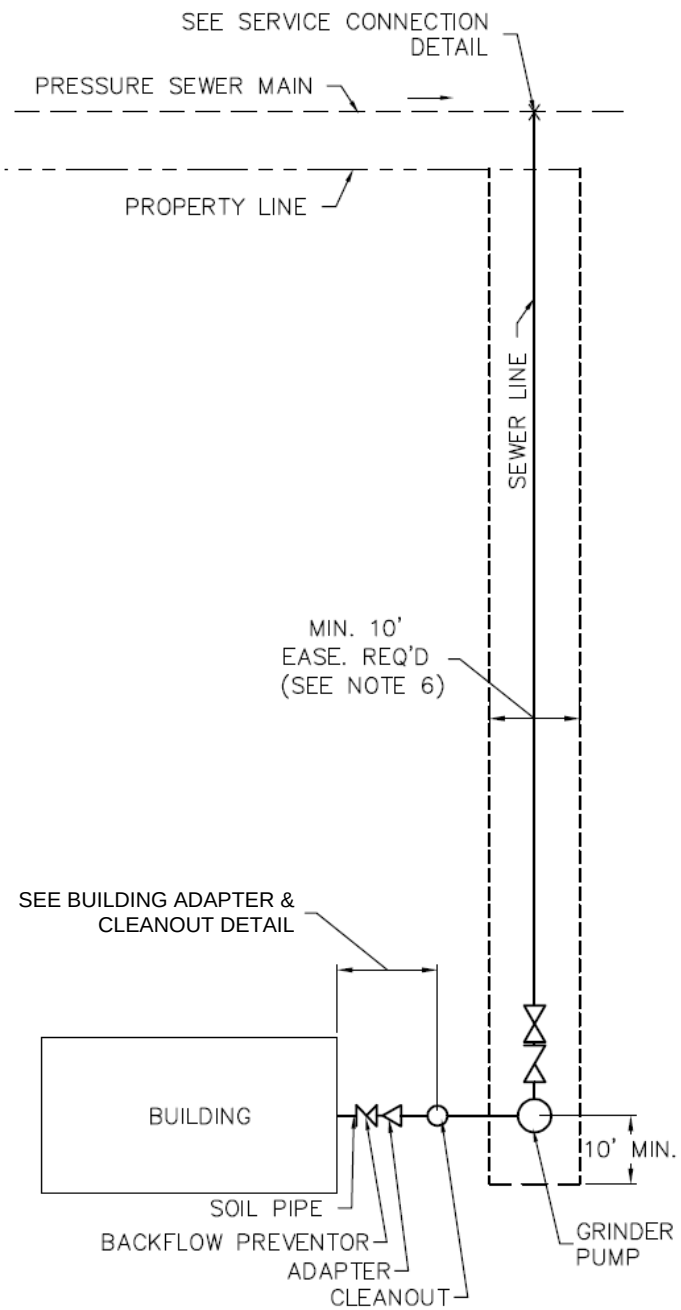
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-14	CUT-IN LATERAL CONNECTION
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



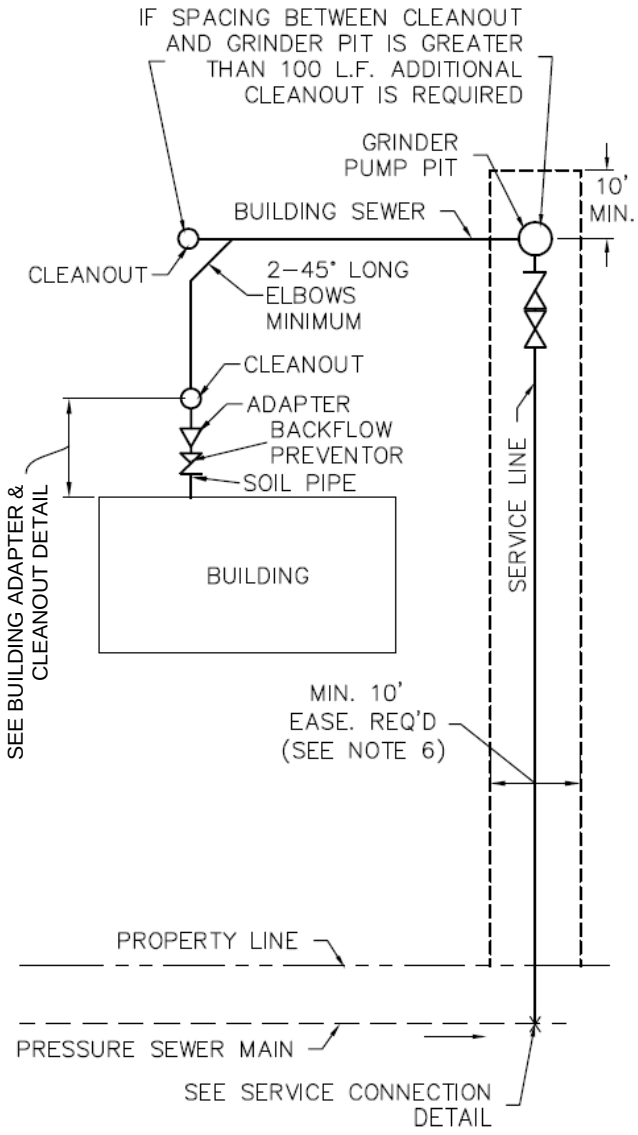
NOTES:

1. PROVIDE TRACER WIRE ON LATERAL PER SPECIFICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-15	SANITARY LATERAL LOWERING	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



SIDE CONNECTION

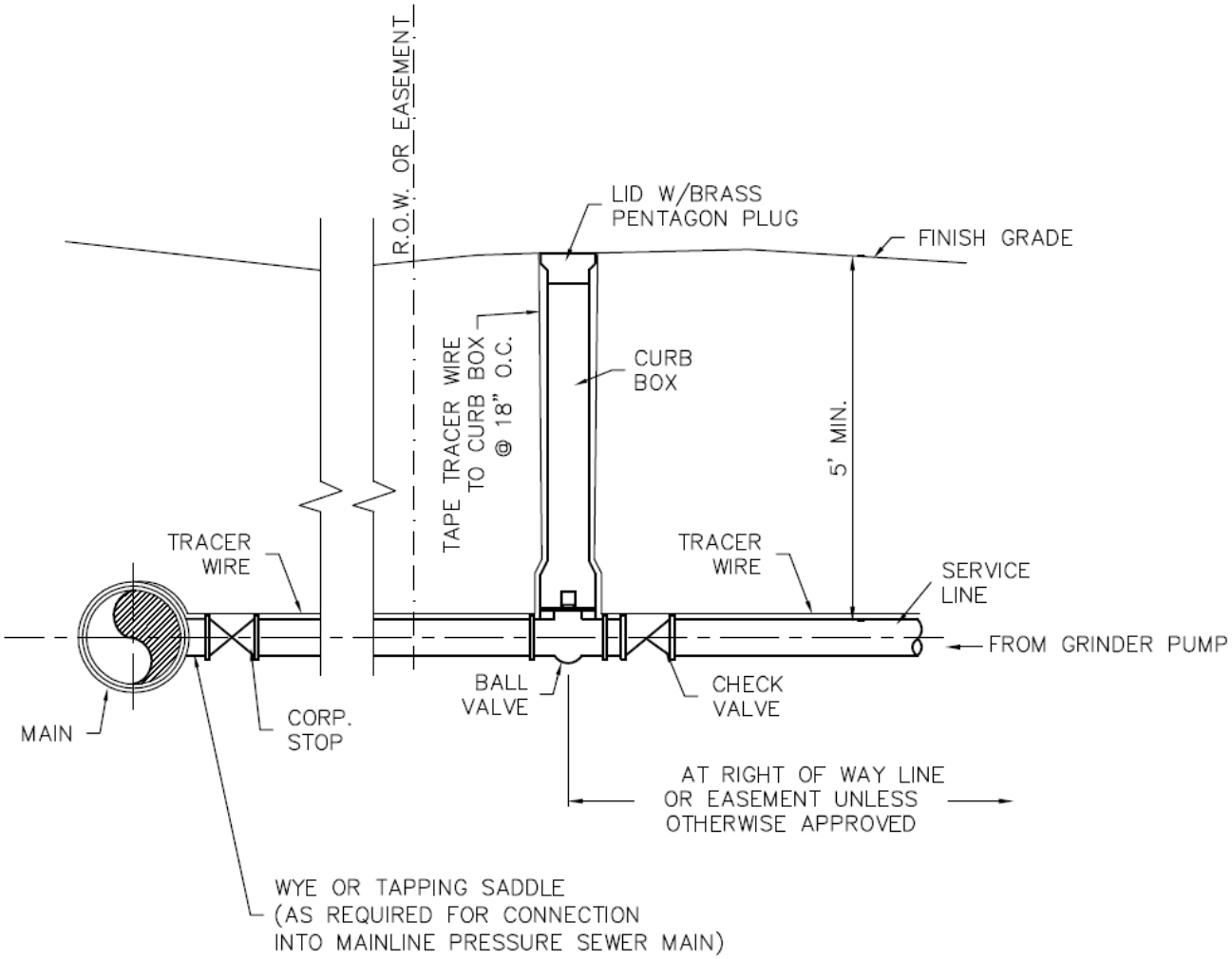


AROUND THE BUILDING CONNECTION

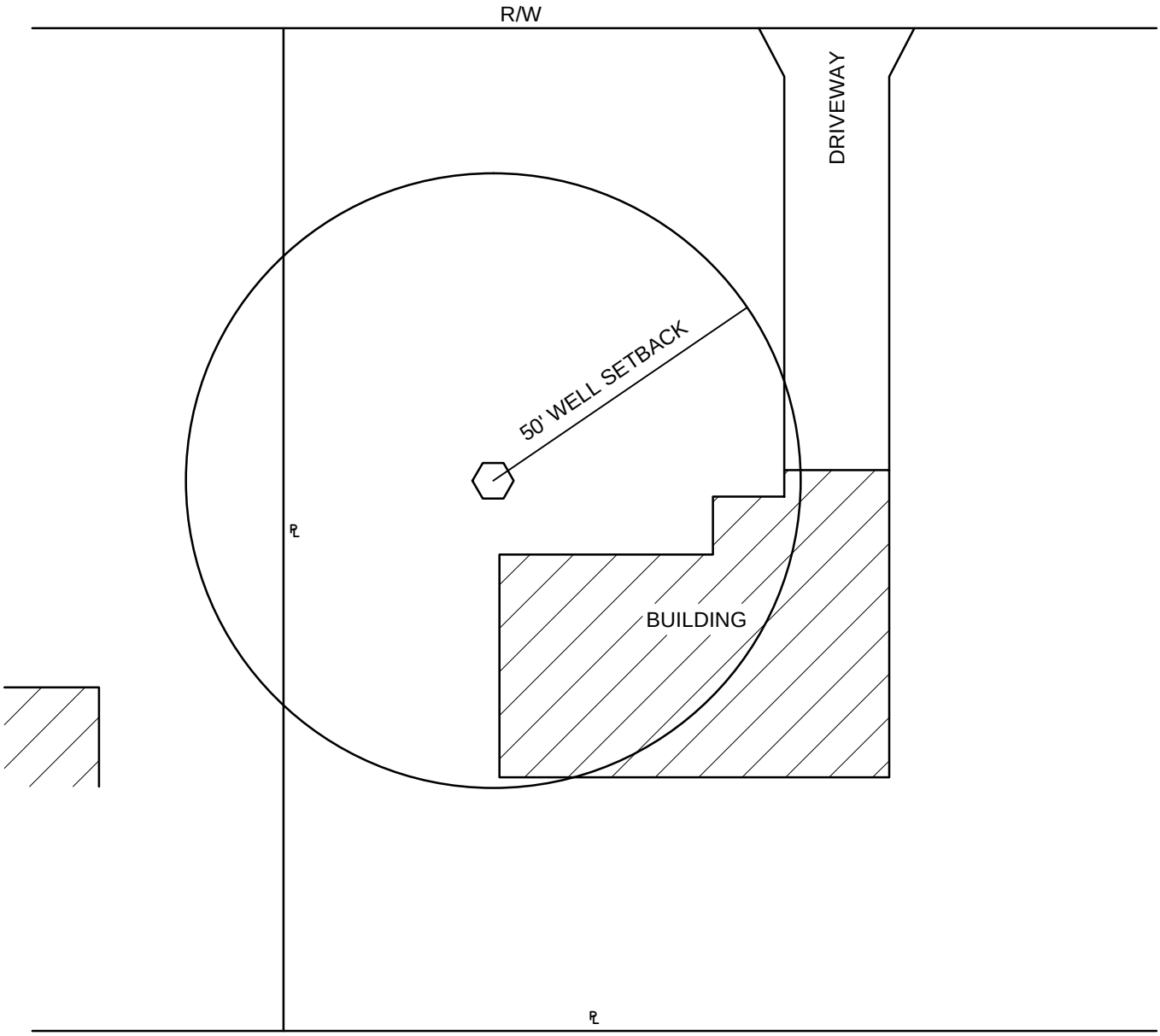
NOTES:

1. MAXIMUM DISTANCES BETWEEN THE EXTERIOR WALL AND THE CLEANOUT WYE SHALL BE 7'.
2. NO 90 DEGREE ELBOW OR TURN IS PERMITTED IN BUILDING SEWER.
3. MINIMUM SLOPE OF BUILDING SEWER SHALL BE 2.0% FOR 4" OR 1.0% FOR 6" DIAMETER PIPE.
4. BUILDING SEWER LINE SHALL BE INSPECTED AND APPROVED BEFORE EXCAVATION IS BACKFILLED.
5. BACKFLOW PREVENTION SHALL BE INSTALLED IN GRAVITY SEWER PIPE BETWEEN GRINDER PUMP AND BUILDING WITHIN FIVE FEET (5') OF BUILDING.
6. 10 FOOT EASEMENT CENTERED ON GRINDER LATERAL AND 10 FEET IN DIAMETER FROM GRINDER STATION CENTER POINT.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-16	PRESSURE SEWER SERVICE LAYOUT
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



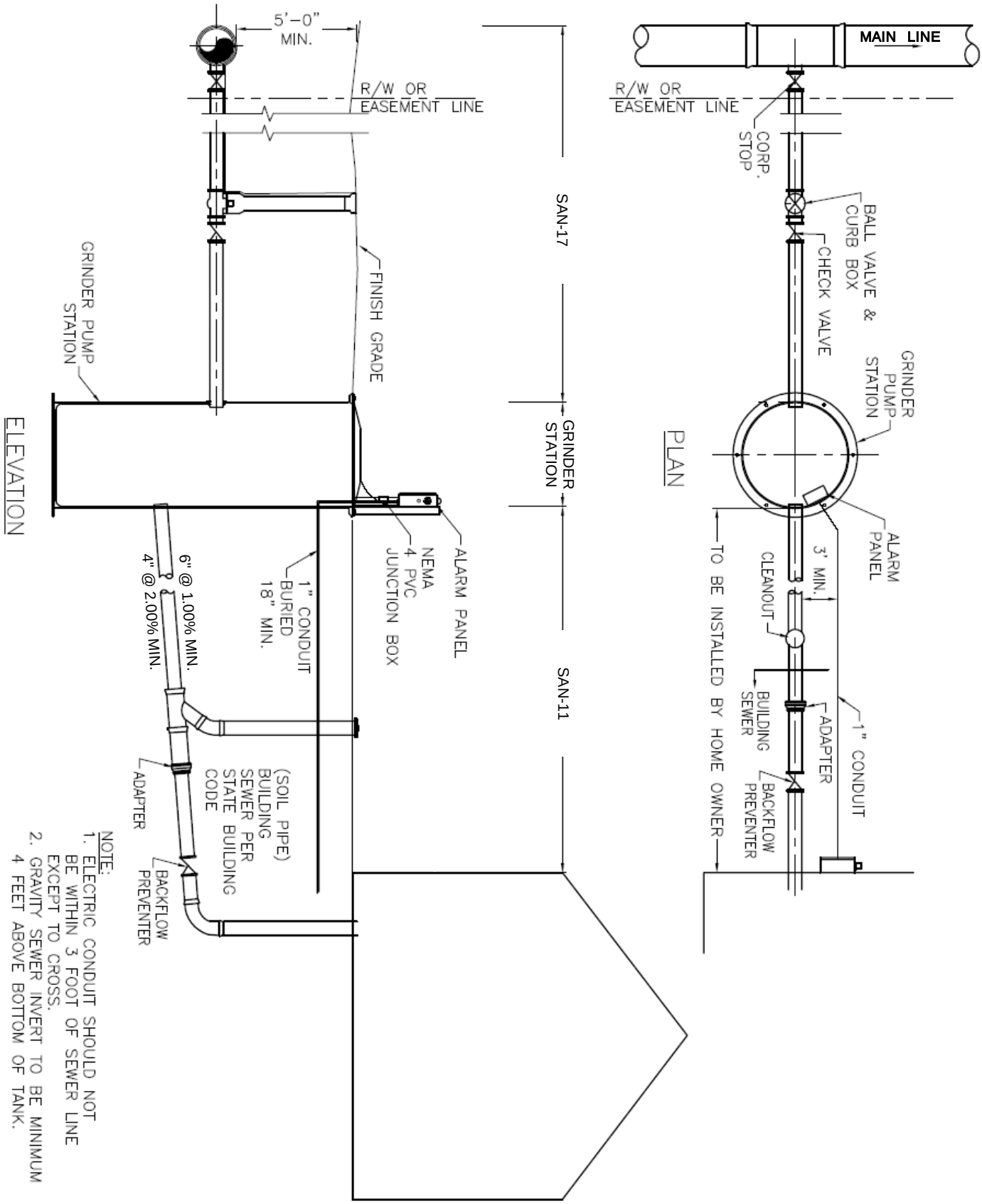
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-17	PRESSURE SEWER SERVICE CONNECTION	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



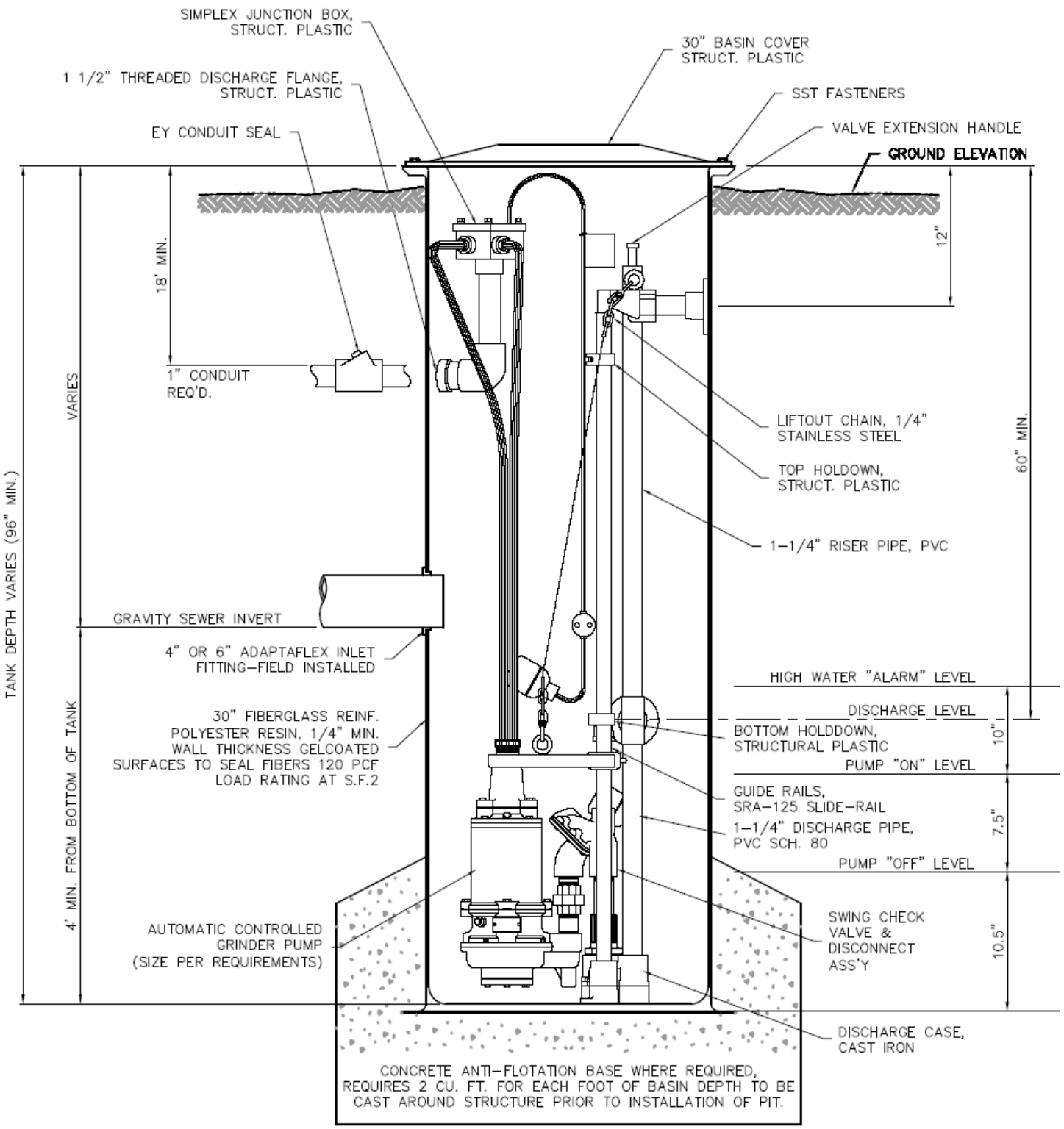
NOTES:

1. ALL SANITARY SEWER MAINS AND BUILDING SERVICE LINES CONSTRUCTED WITHIN 50 FEET OF A WELL SHALL BE CONSTRUCTED USING PRESSURE CLASS PIPING.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-18	SEWER DISTANCE FROM WELL	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-19	TYPICAL GRINDER STATION INSTALLATION
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE

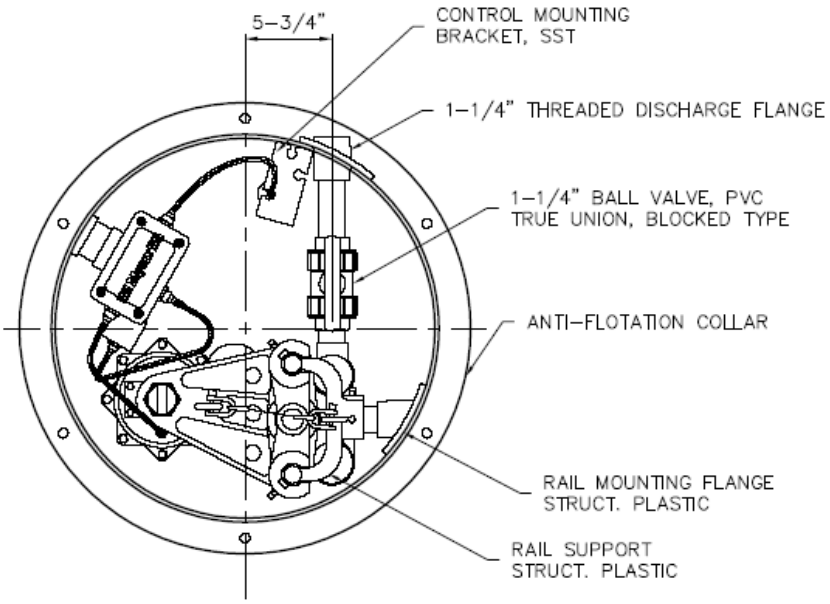


ELEVATION

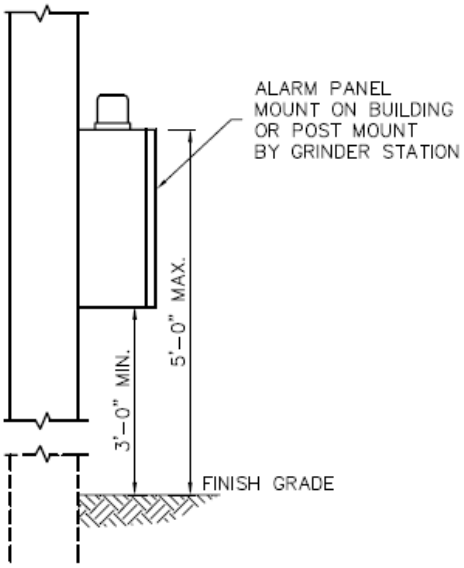
NOTES:

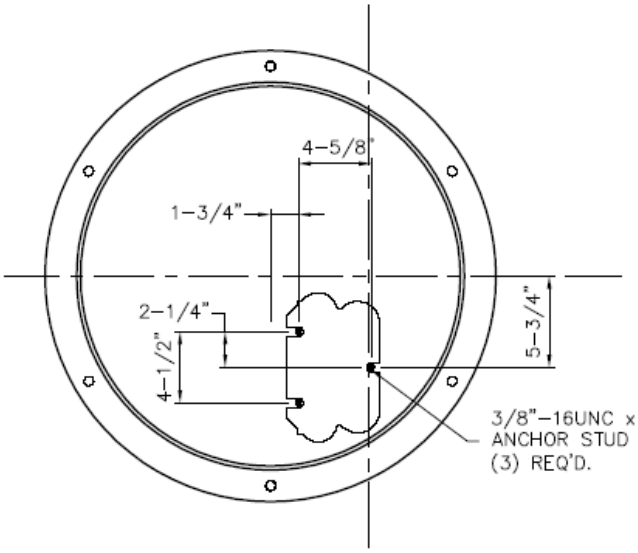
1. GRINDER PACKAGE SHOWN IS SCHEMATIC IN NATURE. TOWN OF CLEAR LAKE TO PROVIDE GRINDER STATION, WHICH MAY DEVIATE FROM STATION SHOWN. COMPLY WITH REQUIREMENTS OF SPECIFICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-20	SIMPLEX GRINDER STATION ELEVATION
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

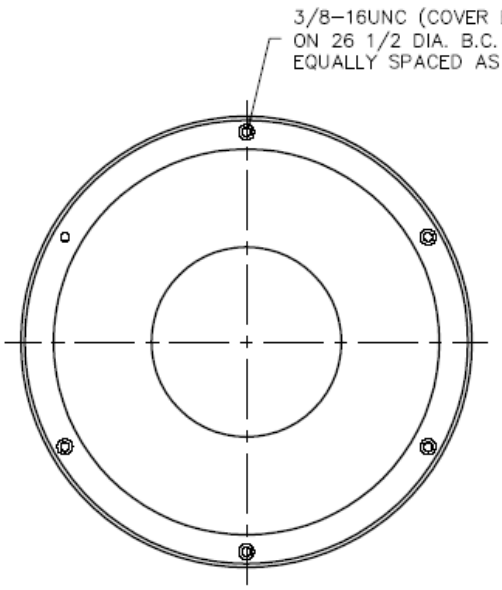


PLAN





BOTTOM PLATE
(ENCAPSULATED STEEL)



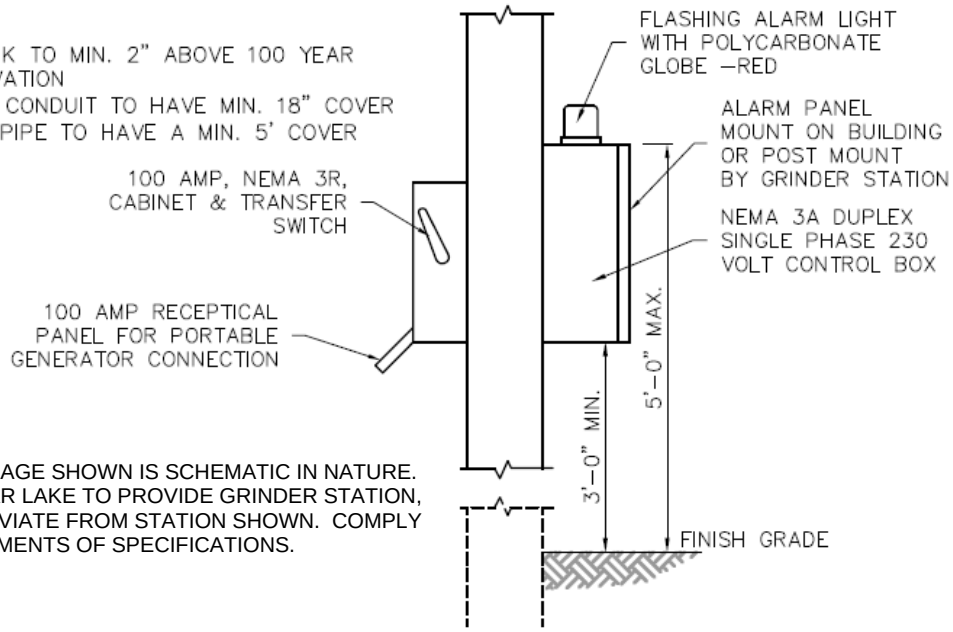
TOP COVER

NOTES:
1) TOP OF TANK TO MIN. 2" ABOVE 100 YEAR FLOOD ELEVATION
2) ELECTRICAL CONDUIT TO HAVE MIN. 18" COVER
3) DISCHARGE PIPE TO HAVE A MIN. 5' COVER

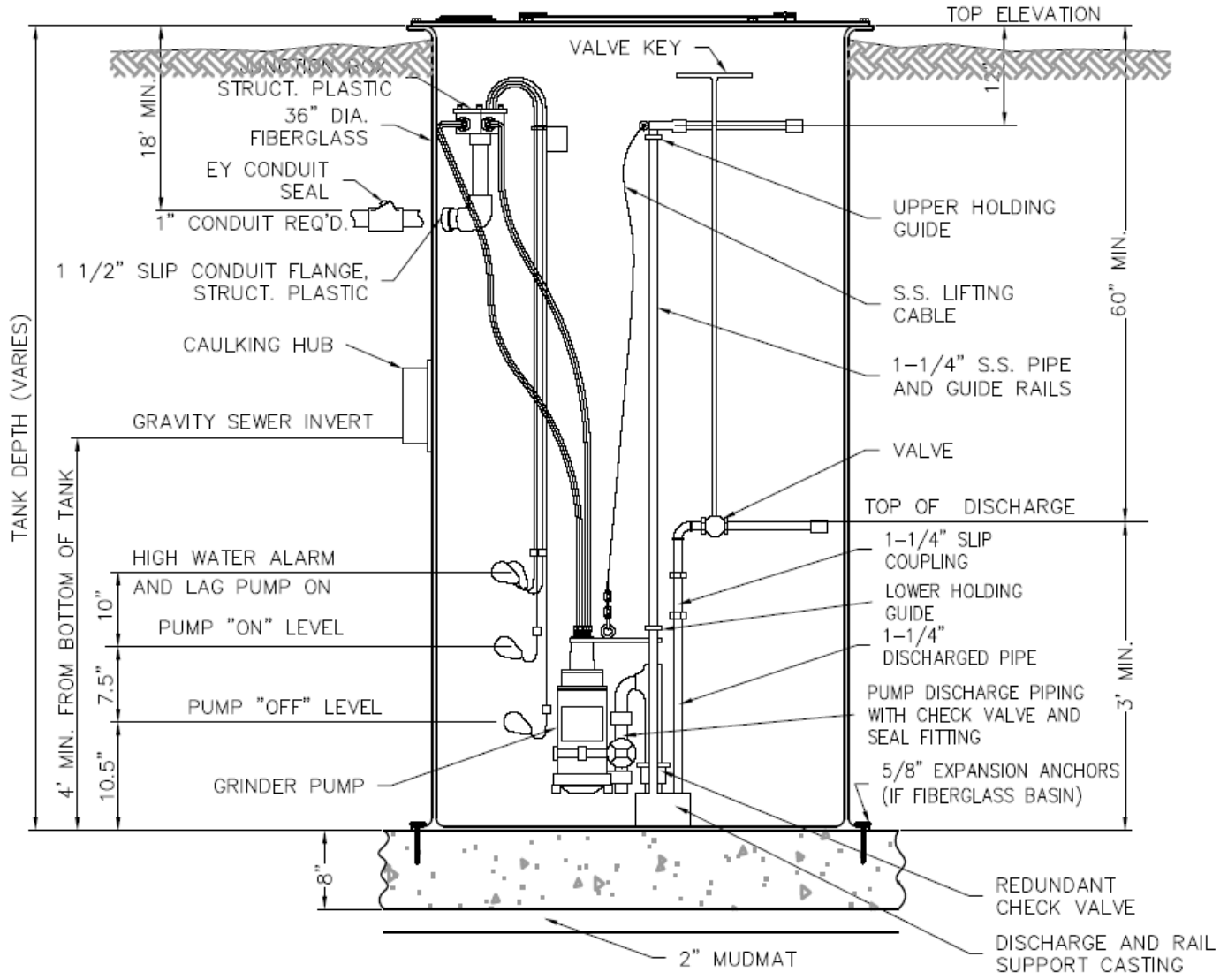
NOTES:
1. GRINDER PACKAGE SHOWN IS SCHEMATIC IN NATURE. TOWN OF CLEAR LAKE TO PROVIDE GRINDER STATION, WHICH MAY DEVIATE FROM STATION SHOWN. COMPLY WITH REQUIREMENTS OF SPECIFICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-21	SIMPLEX GRINDER STATION PLAN
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

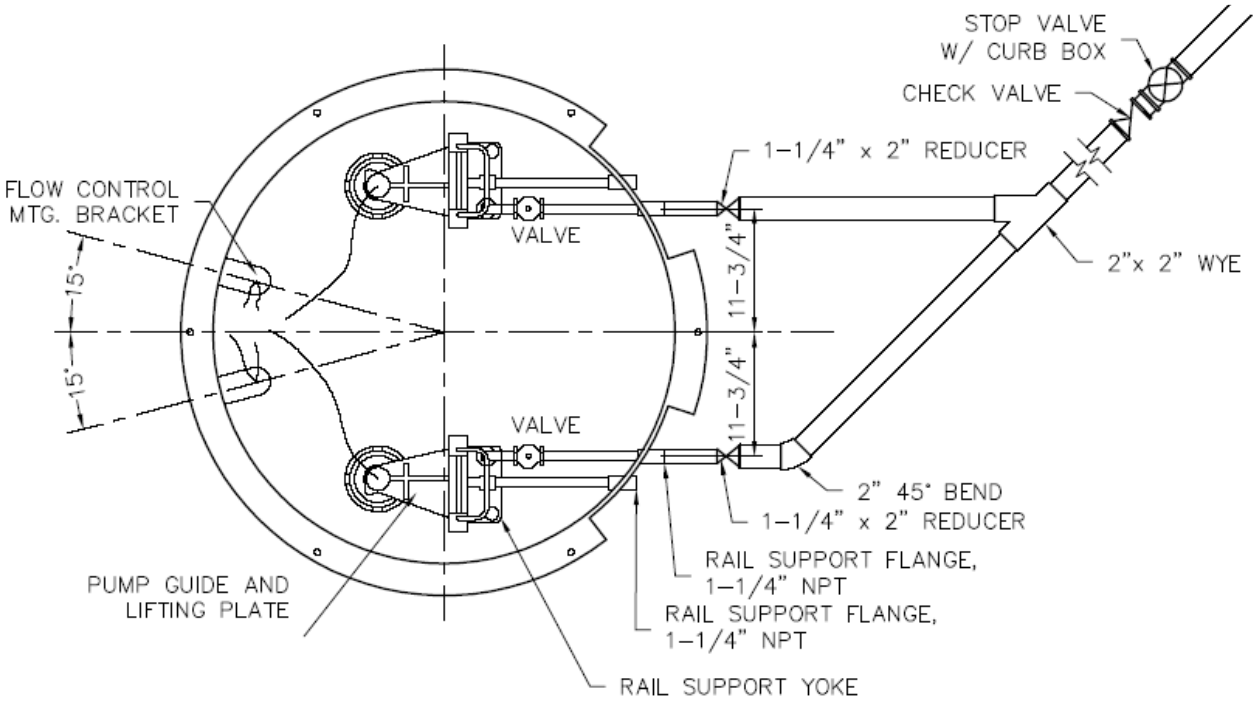
NOTES:
1) TOP OF TANK TO MIN. 2" ABOVE 100 YEAR FLOOD ELEVATION
2) ELECTRICAL CONDUIT TO HAVE MIN. 18" COVER
3) DISCHARGE PIPE TO HAVE A MIN. 5' COVER

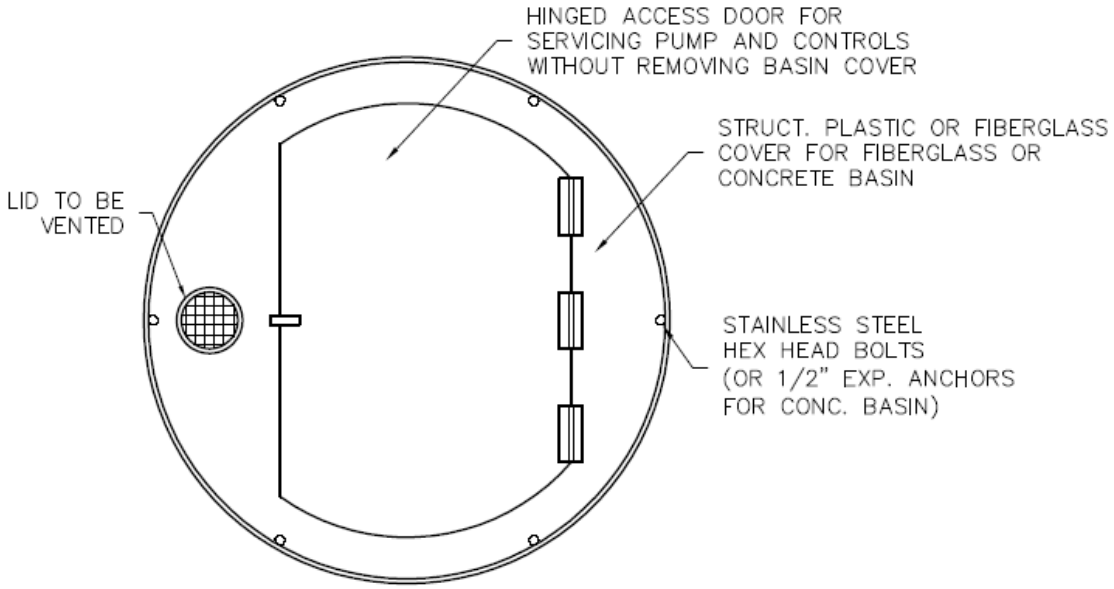


NOTES:
GRINDER PACKAGE SHOWN IS SCHEMATIC IN NATURE. TOWN OF CLEAR LAKE TO PROVIDE GRINDER STATION, WHICH MAY DEVIATE FROM STATION SHOWN. COMPLY WITH REQUIREMENTS OF SPECIFICATIONS.



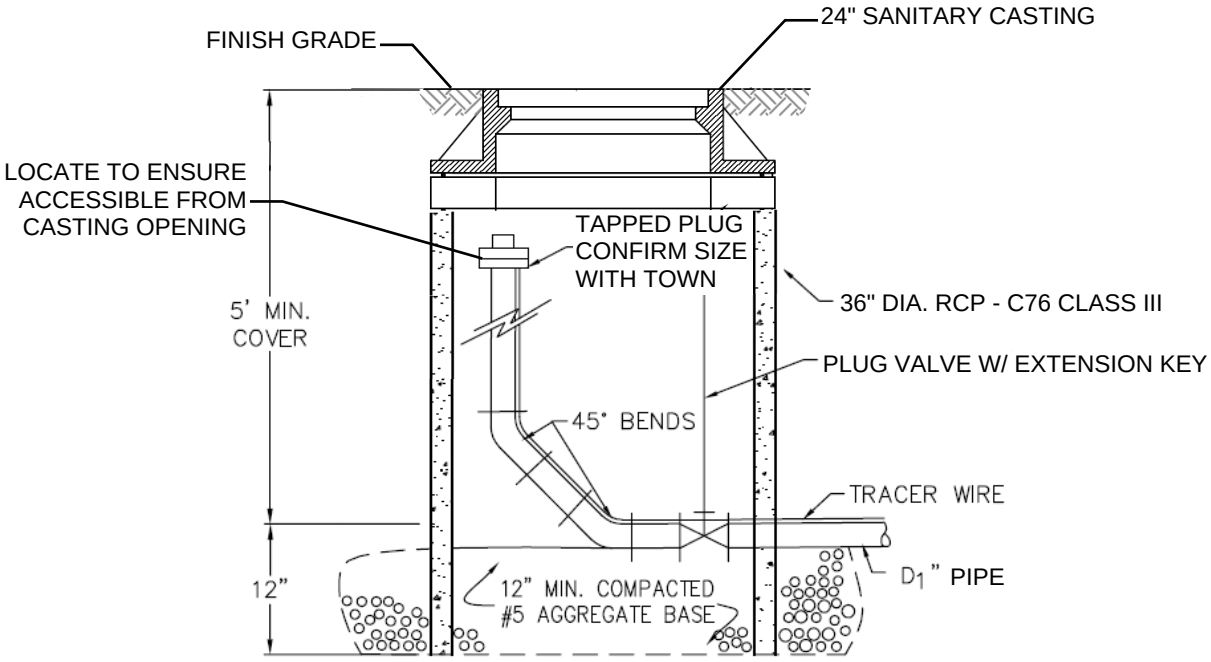
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-22	DUPLEX GRINDER STATION ELEVATION	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



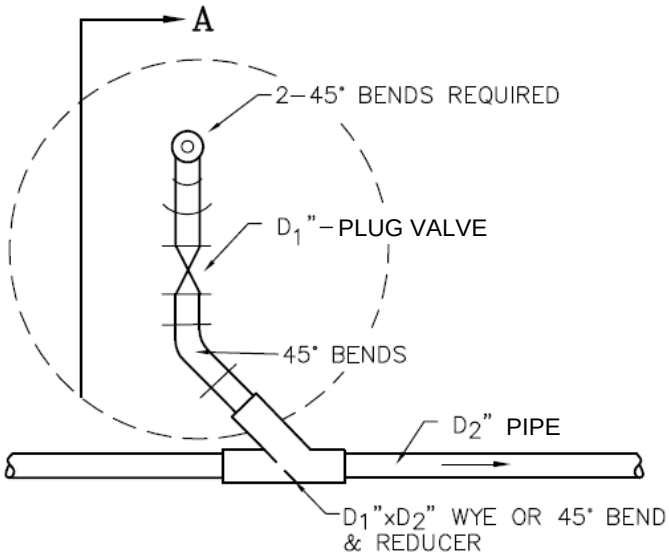


NOTES:
GRINDER PACKAGE SHOWN IS SCHEMATIC IN NATURE. TOWN OF CLEAR LAKE TO PROVIDE GRINDER STATION, WHICH MAY DEVIATE FROM STATION SHOWN. COMPLY WITH REQUIREMENTS OF SPECIFICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-23	DUPLEX GRINDER STATION PLAN
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



SECTION "A"



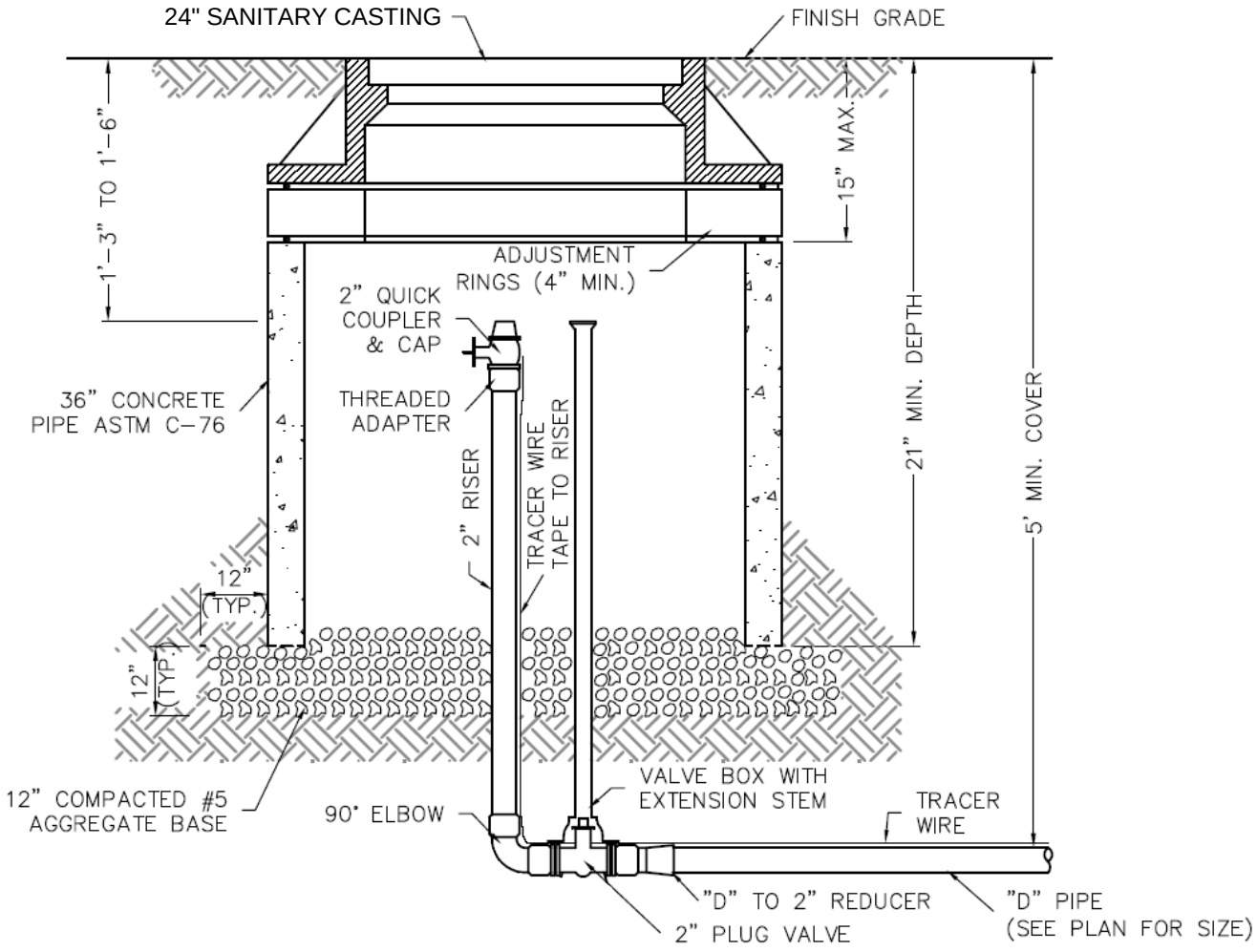
D_x = PIPE DIAMETER

PLAN VIEW

NOTES:

1. PROVIDE ADEQUATE SUPPORT FOR ALL VALVES / FITTINGS TO STRUCTURE WALLS / FLOOR.
2. PROVIDE THRUST RESTRAINT AS REQUIRED BY SPECIFICATIONS.
3. PROVIDE RISER RING OF WIDTH APPROPRIATE TO SUPPORT CASTING OVER STRUCTURE.

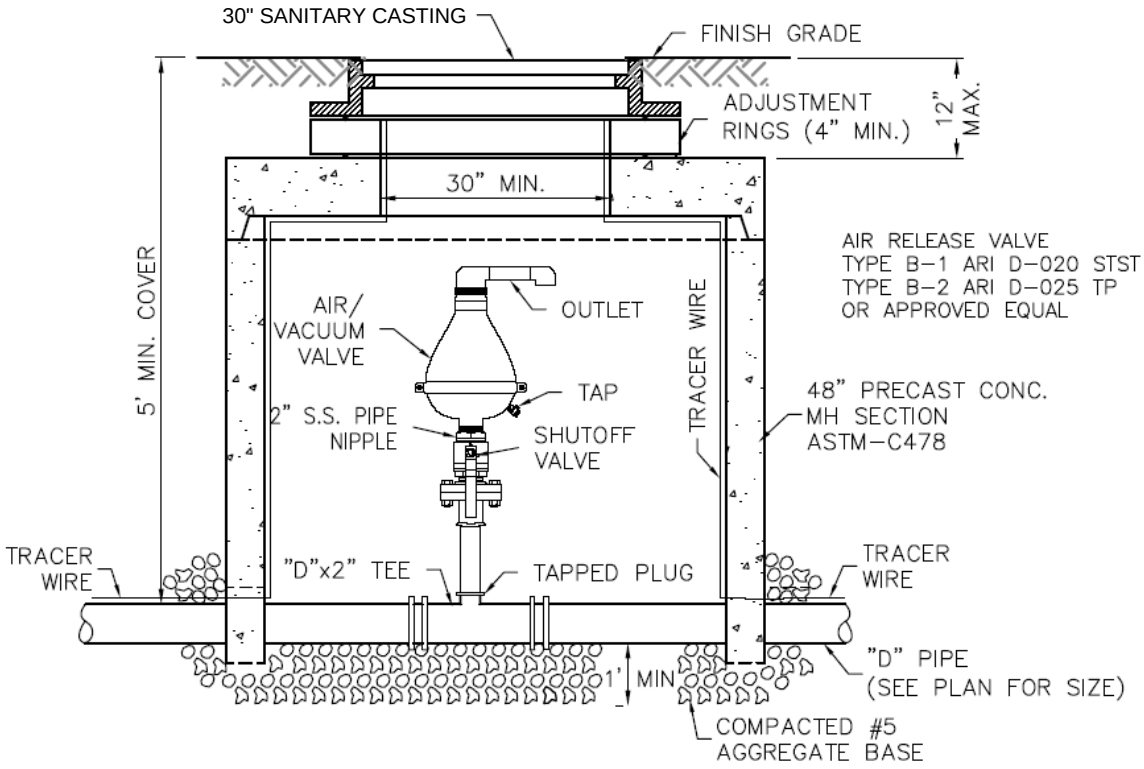
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-24	PRESSURE SEWER CLEANOUT TYPE I	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



NOTES:

1. PROVIDE ADEQUATE SUPPORT FOR ALL VALVES / FITTINGS TO STRUCTURE WALLS / FLOOR.
2. PROVIDE THRUST RESTRAINT AS REQUIRED BY SPECIFICATIONS.
3. PROVIDE RISER RING OF WIDTH APPROPRIATE TO SUPPORT CASTING OVER STRUCTURE.

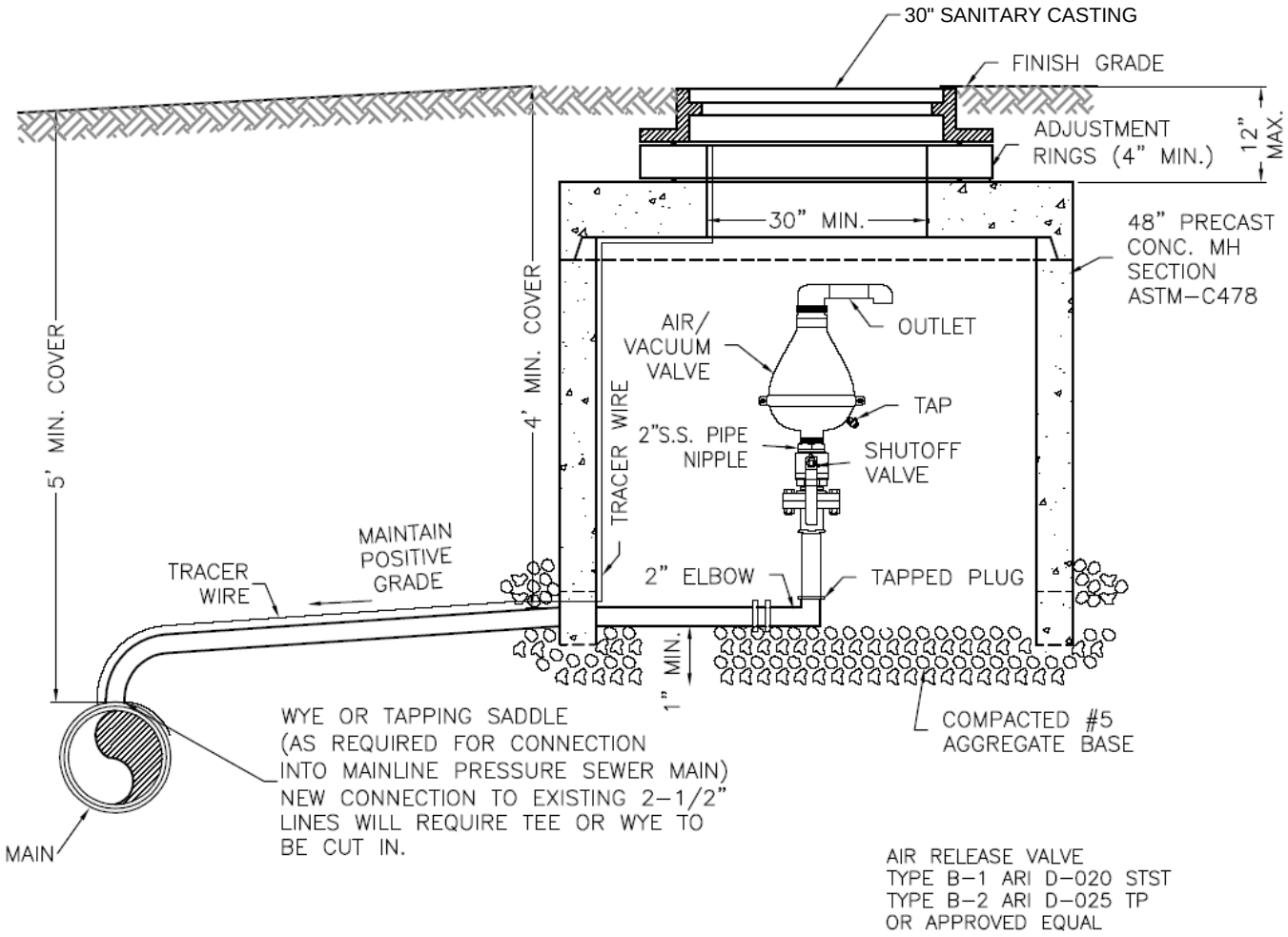
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-25	CLEANOUT & FLUSH VALVE STRUCTURE TYPE A
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



NOTE:

1) THE AIR/VACUUM RELEASE VALVES SHALL MEET THE REQUIREMENTS AS DESCRIBED IN 327 IAC 3-6-13 (5).
2) TRACER WIRE TO BE ANCHORED BELOW THE MANHOLE CASTING.

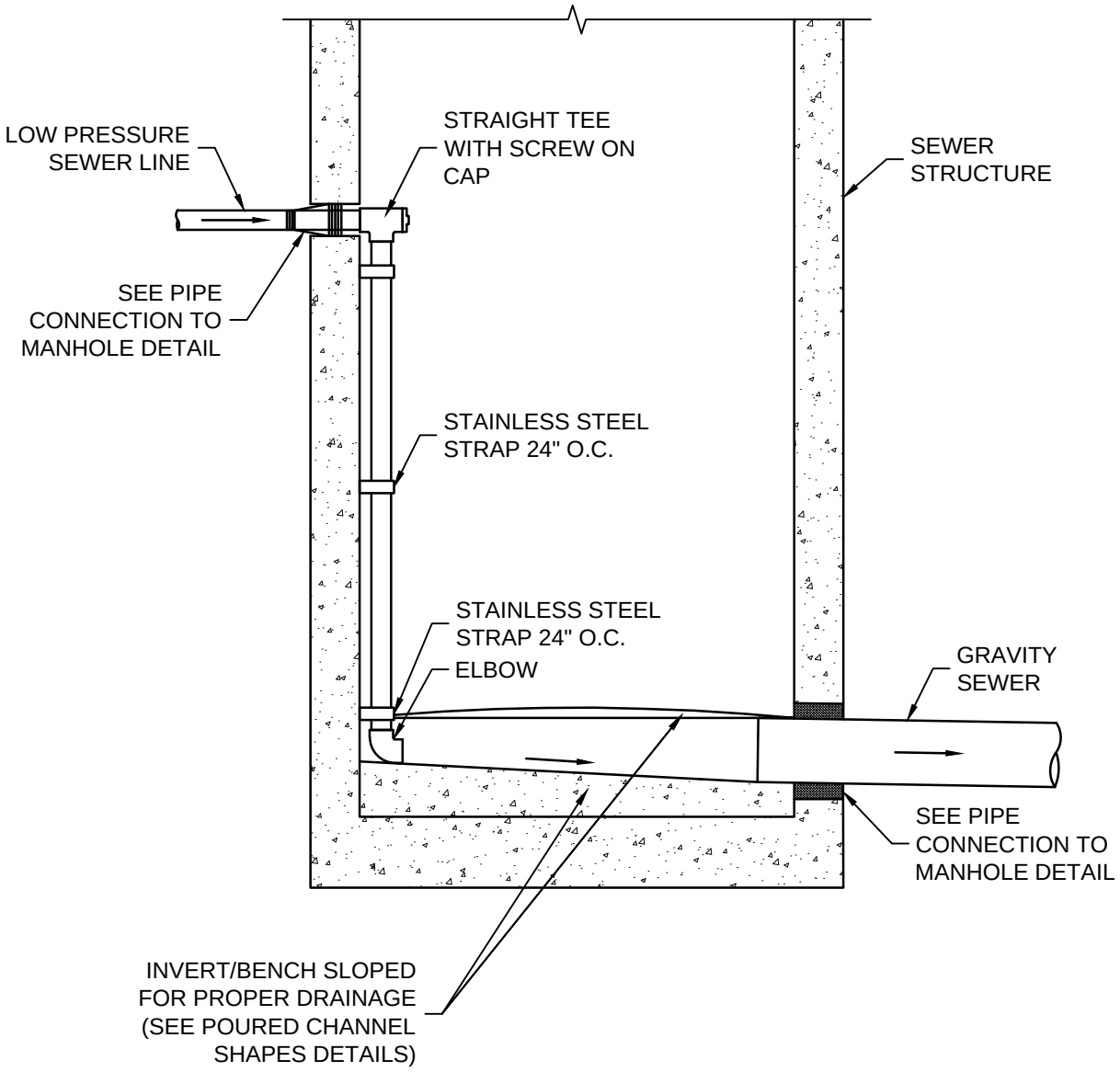
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-26	AIR RELEASE MANHOLE TYPE A	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



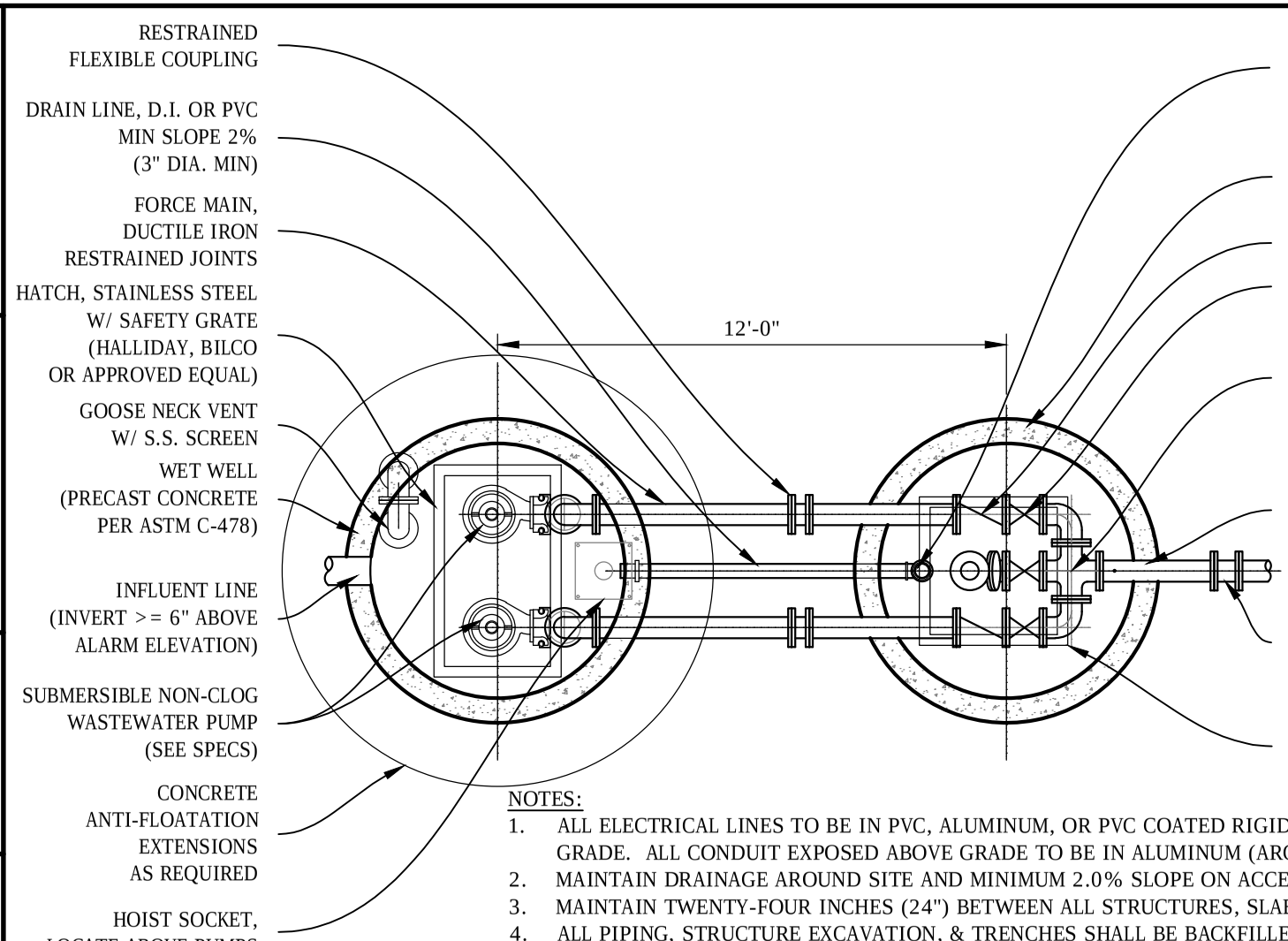
NOTES:

1) THE AIR/VACUUM RELEASE VALVES SHALL MEET THE REQUIREMENTS AS DESCRIBED IN 327 IAC 3-6-13 (5).
2) TRACER WIRE TO BE ANCHORED BELOW THE MANHOLE CASTING.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-27	AIR RELEASE MANHOLE TYPE B
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-28	LOW PRESSURE COLLECTION SYSTEM DISCHARGE
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



NOTES:

1. ALL ELECTRICAL LINES TO BE IN PVC, ALUMINUM, OR PVC COATED RIGID STEEL CONDUIT BELOW GRADE. ALL CONDUIT EXPOSED ABOVE GRADE TO BE IN ALUMINUM (ARC) CONDUIT.
2. MAINTAIN DRAINAGE AROUND SITE AND MINIMUM 2.0% SLOPE ON ACCESS DRIVE.
3. MAINTAIN TWENTY-FOUR INCHES (24") BETWEEN ALL STRUCTURES, SLABS, & FENCING.
4. ALL PIPING, STRUCTURE EXCAVATION, & TRENCHES SHALL BE BACKFILLED WITH A MATERIAL APPROVED BY THE TOWN AND COMPACTED PER TOWN SPECIFICATIONS.
5. INSTALL LIFT OUT RAIL SYSTEMS, VALVES, CONTROLS, ACCESS COVER(S) AND ALL OTHER APPURTENANCES TO MAKE A COMPLETE SYSTEM. LIFT OUT RAIL SYSTEM COMPONENTS AND UPPER GUIDE BRACKETS TO BE STAINLESS STEEL.
6. INSTALL CHECK VALVES AND ISOLATION VALVES.
7. INSTALL ALL TRANSDUCERS/FLOATS, POWER CONNECTIONS, AND MISCELLANEOUS FITTINGS WITHIN THE PUMP CHAMBER. FLOAT SWITCHES TO BE NON-MERCURY TYPE.
8. PROVIDE STAINLESS STEEL LIFTING CHAINS & GUIDE RAILS FOR EACH PUMP.
9. CONTROL PANEL TO INCLUDE: SEAL FAILURE DETECTION, PHASE DETECTION, VISUAL ALARM, AUDIO ALARM, ALTERNATE PUMPS & TIME CLOCK. INSTALL ON METER MOUNTING PEDESTAL OR PROVIDE SEPARATE MOUNTING PANEL. PROVIDE GENERATOR HOOKUP AND TRANSFER SWITCH PER MUNICIPAL REQUIREMENTS. THE PANEL MUST INCLUDE HEATER WITH THERMOSTAT CONTROL.
10. CONTRACTOR TO SUBMIT WIRING DIAGRAM FOR APPROVAL PRIOR TO CONSTRUCTION.

OPTIONAL ITEMS WHICH TOWN MAY REQUIRE:

1. FENCING & GATES
2. METERING PIT & PIPING
3. ON SITE GENERATOR & PAD
4. CHEMICAL TANK
5. TELEMETRY

Town of Clear Lake
Est. 1932

TOWN OF CLEAR LAKE
111 GECOWETS DRIVE
FREMONT, IN 46737

STANDARD DRAWINGS

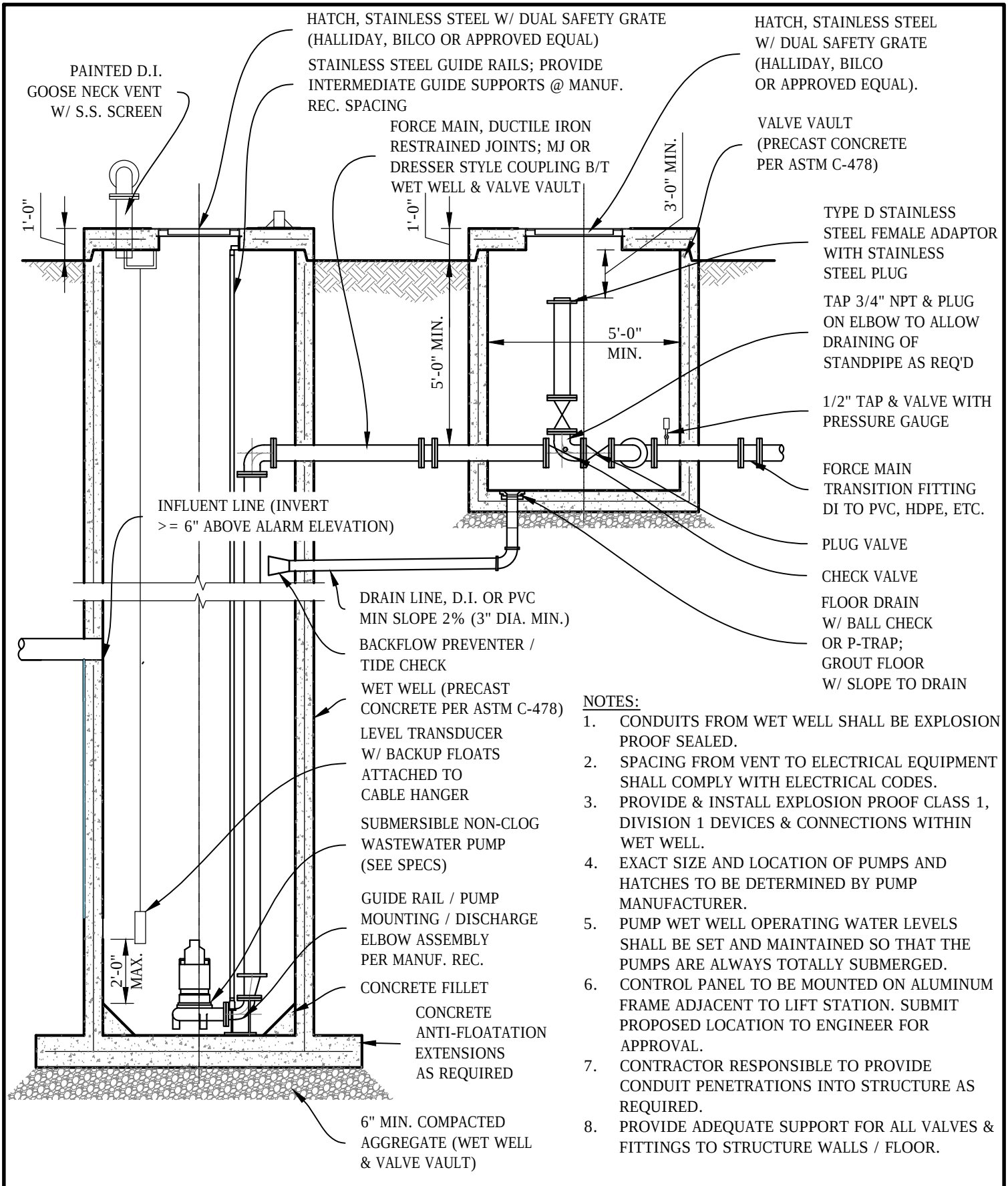
SAN-29

LIFT STATION PLAN

APPROVED: 08/14/17

REVISED:

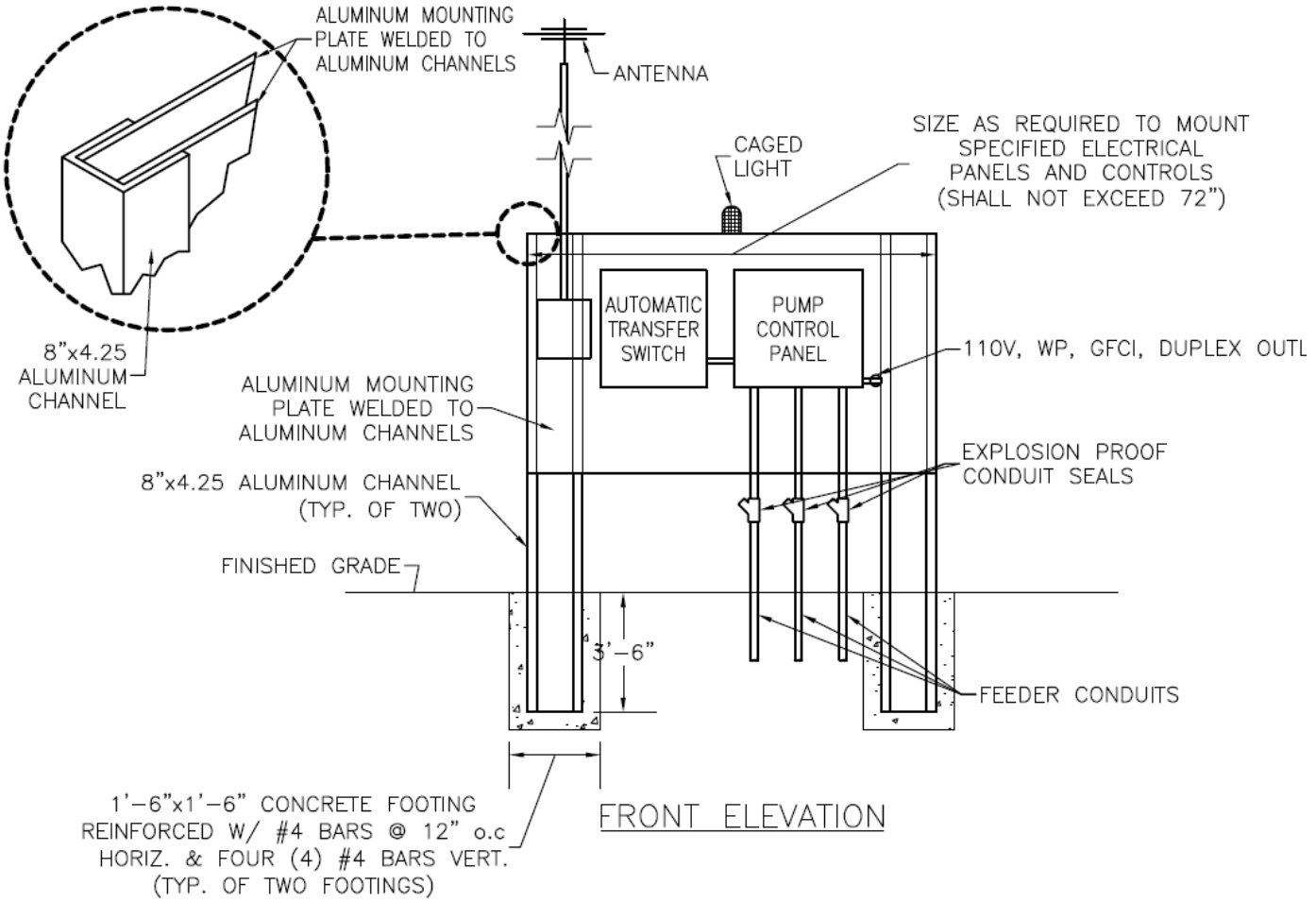
SCALE: AS NOTED

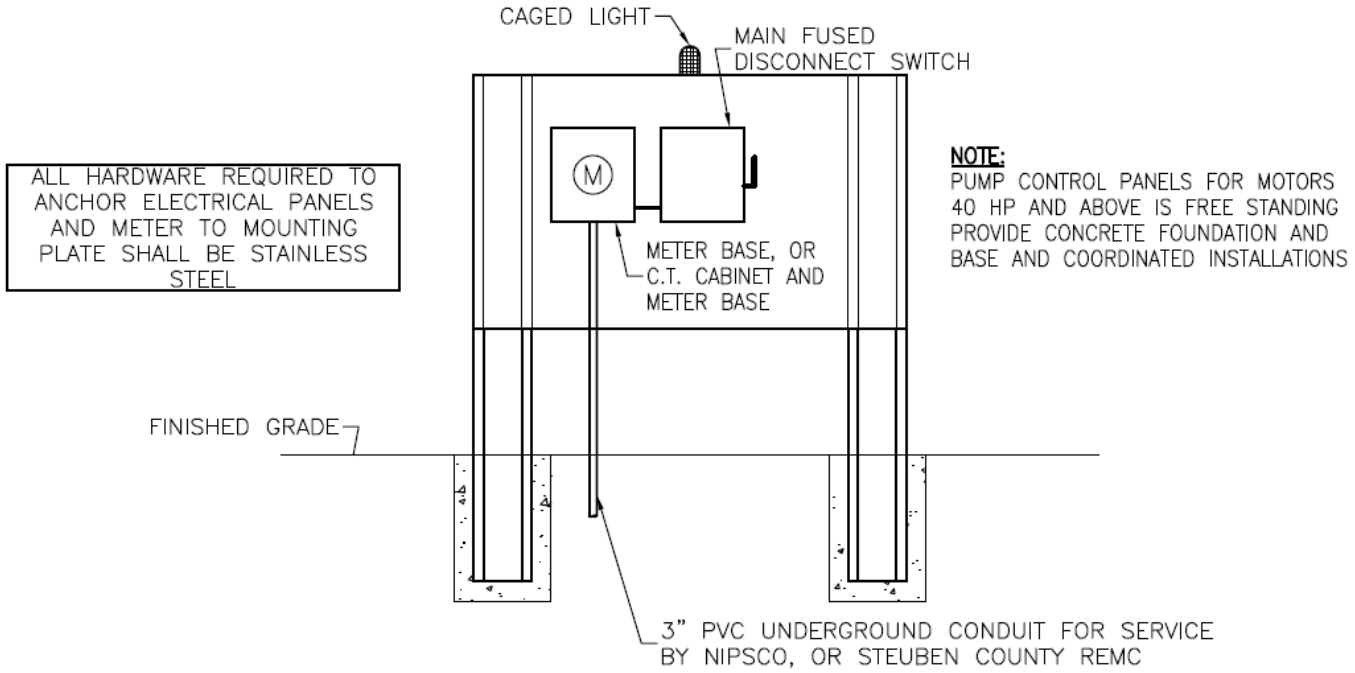


NOTES:

1. CONDUITS FROM WET WELL SHALL BE EXPLOSION PROOF SEALED.
2. SPACING FROM VENT TO ELECTRICAL EQUIPMENT SHALL COMPLY WITH ELECTRICAL CODES.
3. PROVIDE & INSTALL EXPLOSION PROOF CLASS 1, DIVISION 1 DEVICES & CONNECTIONS WITHIN WET WELL.
4. EXACT SIZE AND LOCATION OF PUMPS AND HATCHES TO BE DETERMINED BY PUMP MANUFACTURER.
5. PUMP WET WELL OPERATING WATER LEVELS SHALL BE SET AND MAINTAINED SO THAT THE PUMPS ARE ALWAYS TOTALLY SUBMERGED.
6. CONTROL PANEL TO BE MOUNTED ON ALUMINUM FRAME ADJACENT TO LIFT STATION. SUBMIT PROPOSED LOCATION TO ENGINEER FOR APPROVAL.
7. CONTRACTOR RESPONSIBLE TO PROVIDE CONDUIT PENETRATIONS INTO STRUCTURE AS REQUIRED.
8. PROVIDE ADEQUATE SUPPORT FOR ALL VALVES & FITTINGS TO STRUCTURE WALLS / FLOOR.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-30	LIFT STATION SECTION
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED: SCALE: AS NOTED



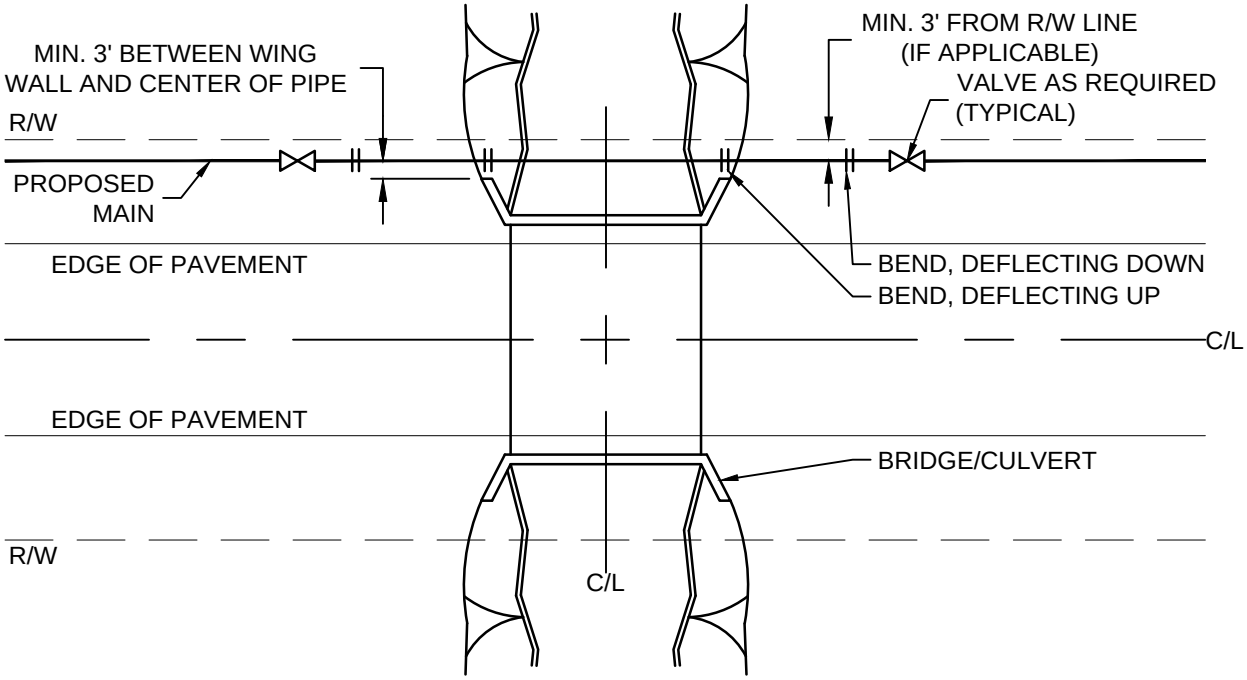


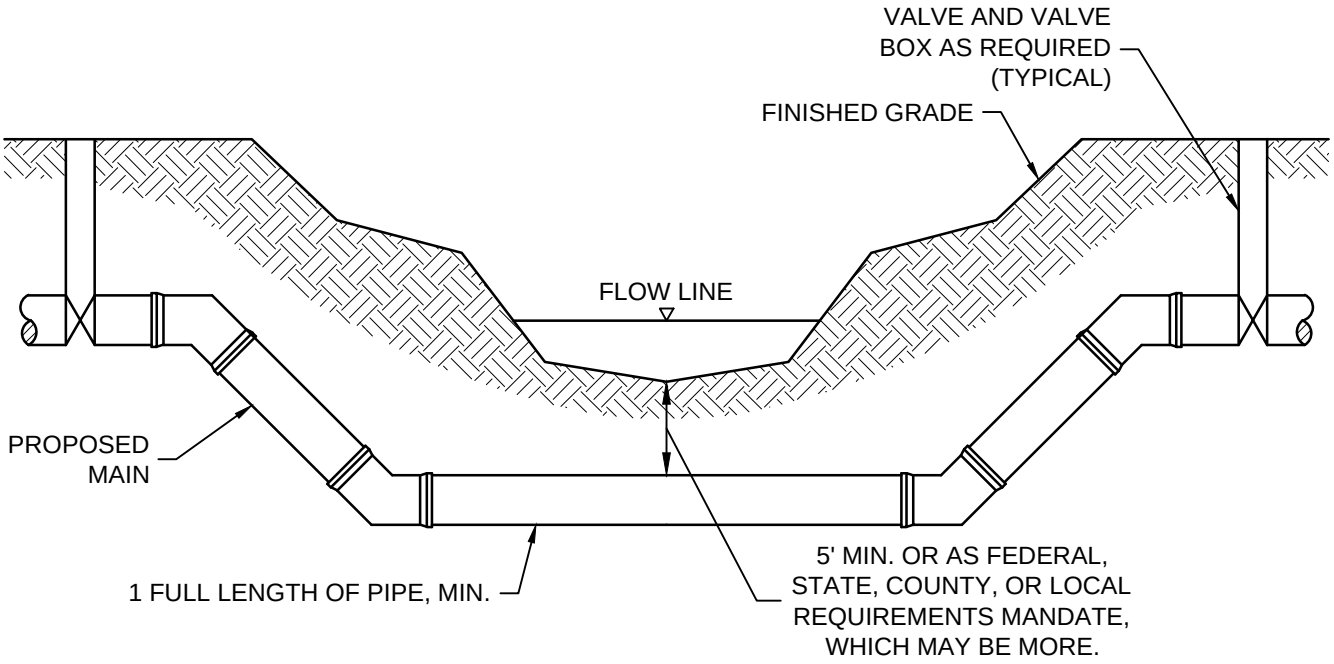
ALL HARDWARE REQUIRED TO ANCHOR ELECTRICAL PANELS AND METER TO MOUNTING PLATE SHALL BE STAINLESS STEEL

NOTE:
PUMP CONTROL PANELS FOR MOTORS 40 HP AND ABOVE IS FREE STANDING PROVIDE CONCRETE FOUNDATION AND BASE AND COORDINATED INSTALLATIONS

REAR ELEVATION

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-31	LIFT STATION POWER CONNECTION
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

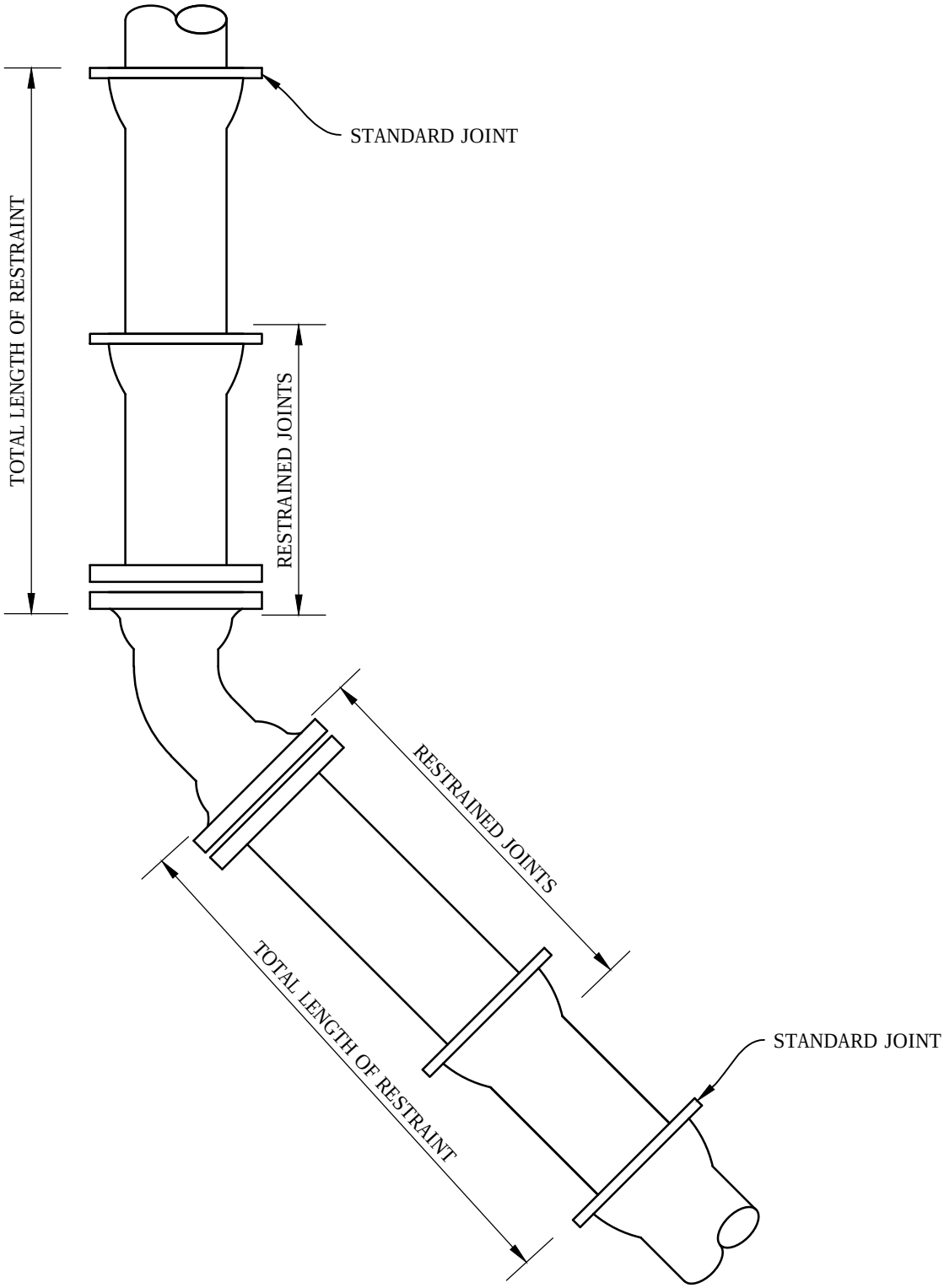




NOTES:

1. EXCAVATION WITHIN STREAM BED TO BE BACKFILLED WITH APPROVED MATERIALS AND COMPACTED. RESTRAIN PER PROJECT PLANS.
2. FOR MAINS 12" AND LARGER, 22 1/2 DEGREE BENDS SHALL BE USED.
3. RIPRAP ENTIRE WIDTH OF TRENCH + 12" EACH SIDE FROM TOP OF BANK TO TOP OF BANK. PROVIDE 18" REVETMENT RIPRAP, 24" CLASS I RIPRAP, OR 30" CLASS II RIPRAP OVER GEOTEXTILES AS REQUIRED BY PERMITTING AGENCY.
4. HDPE PIPE MAY BE DEFLECTED IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS IN LIEU OF PROVIDING ELBOWS.

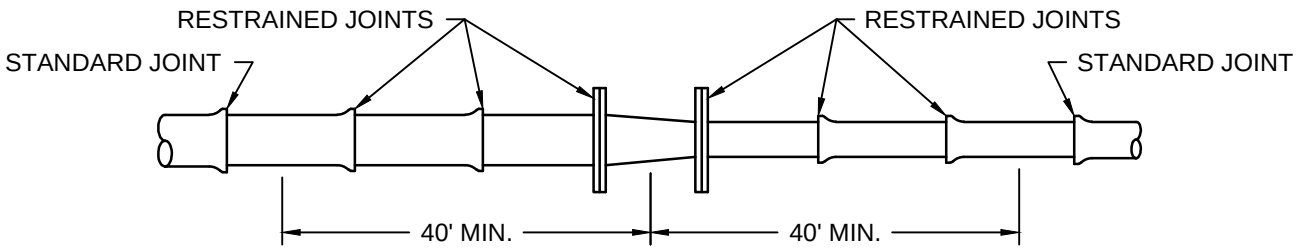
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-32	TYPICAL CHANNEL CROSSING FOR PRESSURE MAINS	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



NOTE:

1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-33	RESTRAINT OF ELBOWS	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED

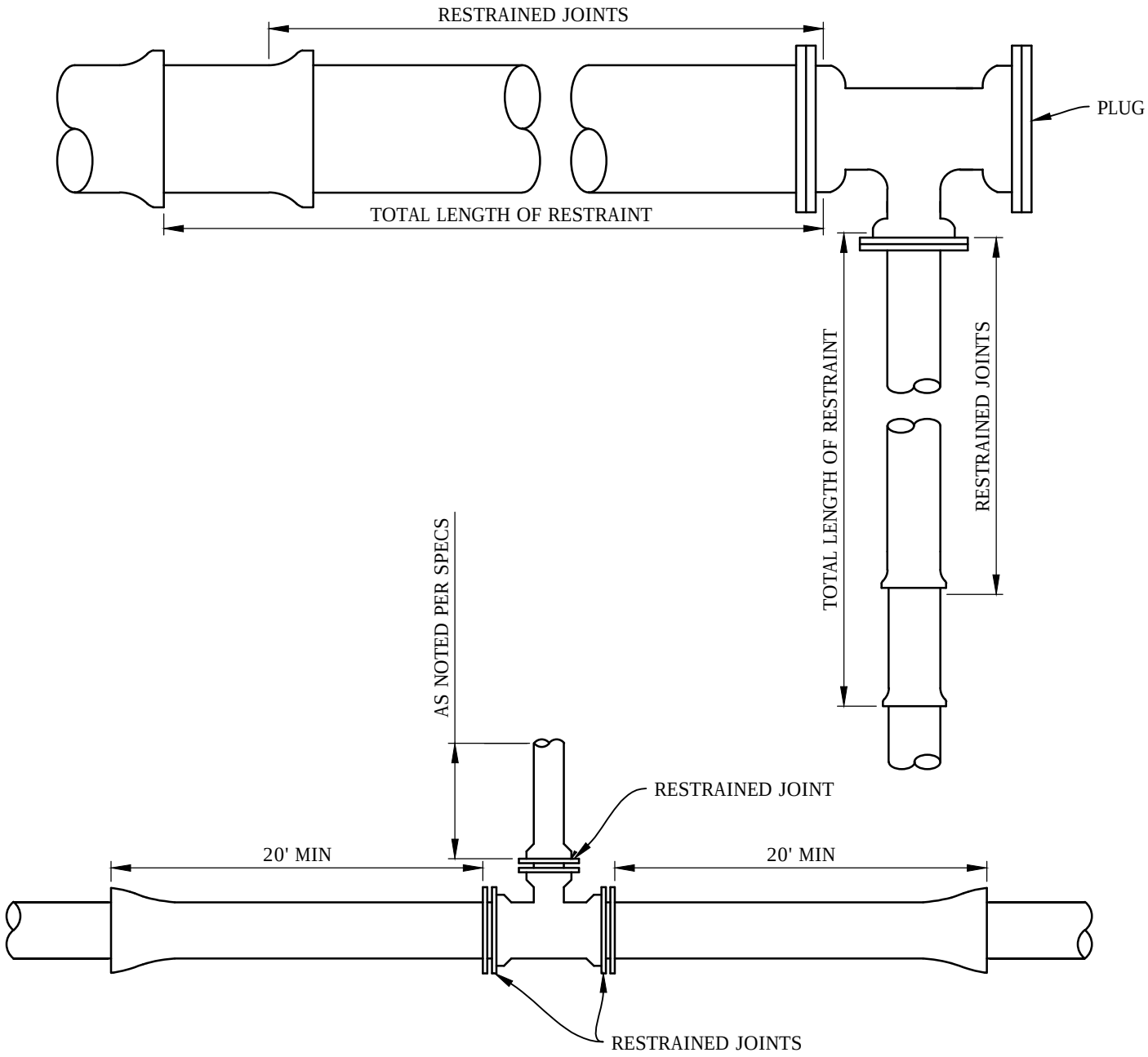


REDUCERS, LARGER PIPE DIAMETER IS 20" OR SMALLER

NOTES:

1. ASSUMPTIONS (PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY)
   - 1.1 BASED ON REDUCTION OF ONE PIPE SIZE
   - 1.2 BASED ON 150 PSI DESIGN / TEST PRESSURE
   - 1.3 SAFETY FACTOR 1.5
   - 1.4 TYPE 3 LAYING CONDITION
   - 1.5 5' COVER
   - 1.6 SOIL / BACKFILL CONDITIONS = CLAY 2
2. IF FITTINGS ARE IN CLOSE PROXIMITY TO EACH OTHER AND THE RESTRAINT LENGTHS OVERLAP, REFER TO THE DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

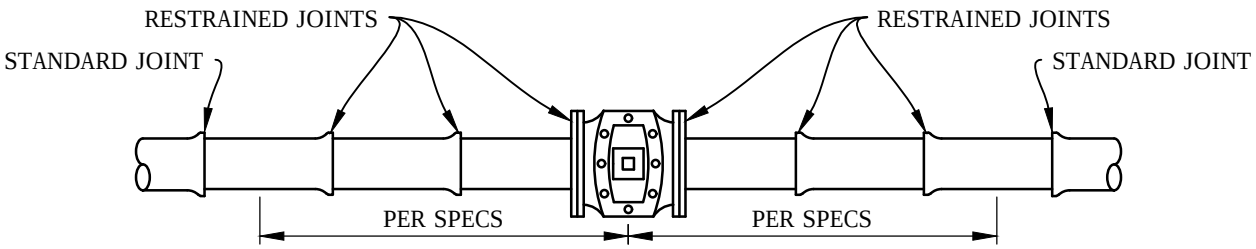
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-34	RESTRAINT OF REDUCERS	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE:



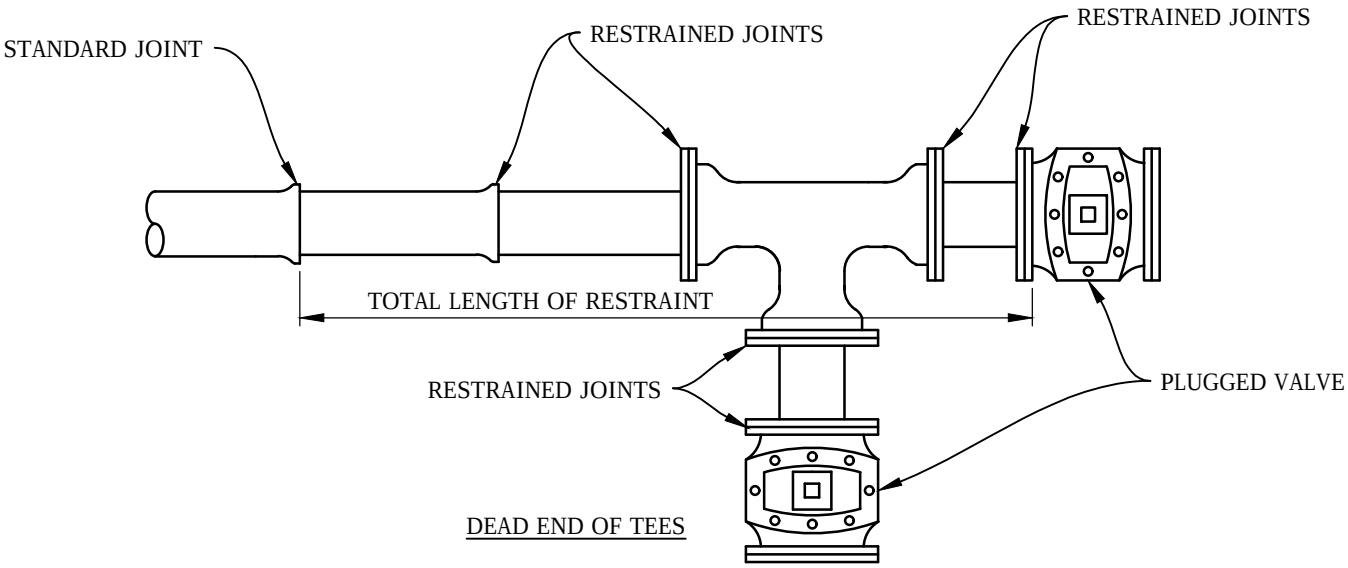
NOTE:

1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

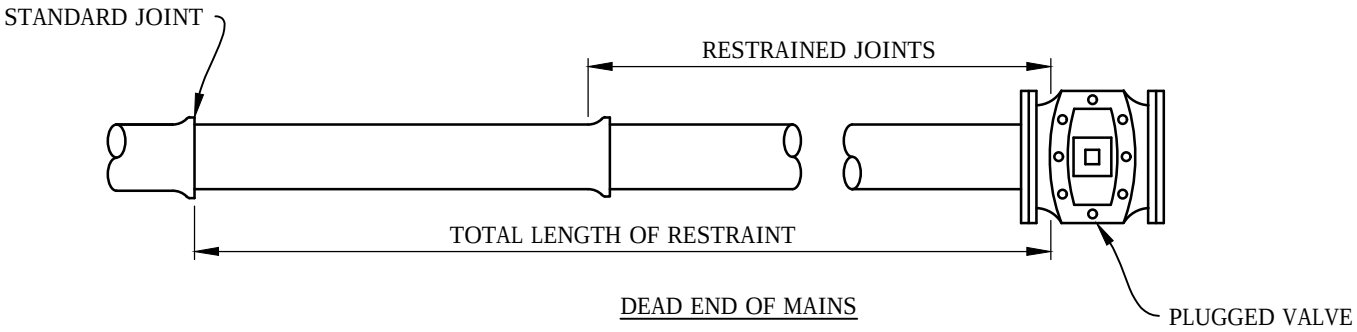
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-35	RESTRAINT OF TEES	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED



NON DEAD END



DEAD END OF TEES



DEAD END OF MAINS

NOTE:

1. SEE SPECIFICATIONS FOR REQUIRED RESTRAINT LENGTHS

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-36	RESTRAINT OF VALVES
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED

NON-POLYWRAPPED DIP THRUST RESTRAINT CALCULATIONS								
PIPE DIA.	HORIZONTAL BENDS AND VERTICAL UP BENDS				VERTICAL DOWN BENDS		DEAD ENDS	PIPE DIA.
	11.25°	22.5°	45°	90°	22.5°	45°		
4"	1	3	6	15	5	11	27	4"
6"	2	4	9	21	8	16	39	6"
8"	3	5	11	27	10	21	51	8"
10"	3	7	14	33	12	26	62	10"
12"	4	8	16	40	15	31	74	12"
16"	5	10	21	52	19	41	98	16"
20"	6	13	26	64	24	50	122	20"
24"	7	15	31	76	29	60	145	24"
30"	9	19	39	93	36	75	180	30"
36"	11	22	46	110	43	89	215	36"

TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20FT EACH SIDE OF TEE)											
	TEE BRANCH DIAMETER										
TEE RUN DIA.	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	TEE RUN DIA.
4"	0										4"
6"	0	0									6"
8"	0	0	0								8"
10"	0	0	0	5							10"
12"	0	0	0	0	11						12"
16"	0	0	0	0	3	22					16"
20"	0	0	0	0	0	16	34				20"
24"	0	0	0	0	0	9	28	45			24"
30"	0	0	0	0	0	0	21	39	62		30"

NOTES:

1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.
   - 1.1 NON- POLYWRAPPED DUCTILE IRON PIPE
   - 1.2 DESIGN / TEST PRESSURE = 150 PSI
   - 1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
   - 1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
   - 1.5 5' COVER
   - 1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)
2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-37	NON-POLYWRAPPED D.I. THRUST RESTRAINT CALCULATIONS
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

POLYWRAPPED DUCTILE IRON THRUST RESTRAINT CALCULATIONS								
PIPE DIA.	HORIZONTAL BENDS AND VERTICAL UP BENDS				VERTICAL DOWN BENDS		DEAD ENDS	PIPE DIA.
	11.25°	22.5°	45°	90°	22.5°	45°		
4"	2	3	7	17	8	16	39	4"
6"	2	5	10	25	11	23	55	6"
8"	3	6	13	33	14	30	73	8"
10"	4	8	16	40	18	37	89	10"
12"	5	9	20	47	21	44	106	12"
16"	6	12	23	62	28	58	140	16"
20"	7	15	31	76	35	72	174	20"
24"	9	18	37	90	41	86	207	24"
30"	11	22	46	110	51	107	257	30"
36"	13	26	54	131	61	127	308	36"

TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20' EACH SIDE OF TEE)											
	TEE BRANCH DIAMETER										
TEE RUN DIA.	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	TEE RUN DIA.
4"	0										4"
6"	0	0									6"
8"	0	0	0								8"
10"	0	0	0	7							10"
12"	0	0	0	0	16						12"
16"	0	0	0	0	4	32					16"
20"	0	0	0	0	0	23	48				20"
24"	0	0	0	0	0	14	41	65			24"
30"	0	0	0	0	0	0	30	55	89		30"
36"	0	0	0	0	0	0	18	46	81	113	36"

NOTES:

1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.
   1.1 POLYWRAPPED DUCTILE IRON PIPE
   1.2 DESIGN / TEST PRESSURE = 150 PSI
   1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
   1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
   1.5 5' COVER
   1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)
2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-38	POLYWRAPPED DIP THRUST RESTRAINT CALCULATIONS
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

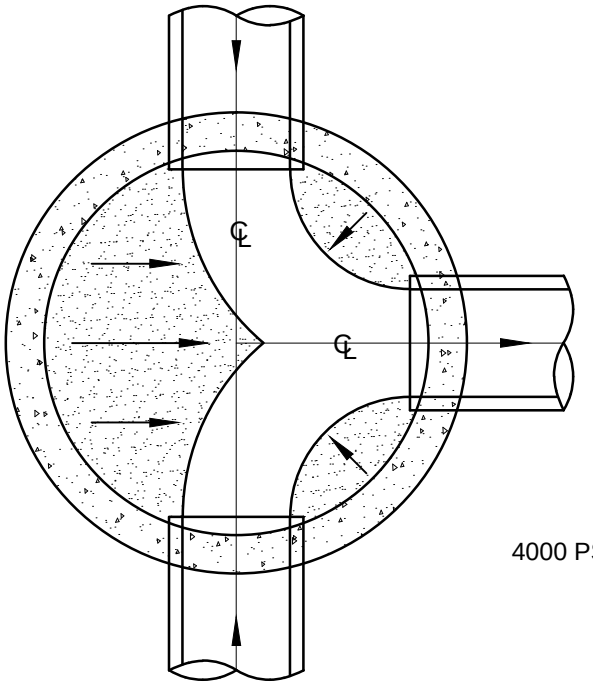
PVC NON-ENCROACHING THRUST RESTRAINT CALCULATIONS								
PIPE DIA.	HORIZONTAL BENDS AND VERTICAL UP BENDS				VERTICAL DOWN BENDS		DEAD ENDS	PIPE DIA.
	11.25°	22.5°	45°	90°	22.5°	45°		
4"	1	3	5	13	7	15	25	4"
6"	2	4	8	19	10	22	35	6"
8"	2	5	10	24	13	28	47	8"
10"	3	6	12	29	16	34	56	10"
12"	3	7	14	35	19	40	67	12"
16"	4	9	19	45	25	53	87	16"
20"	5	11	23	55	31	65	107	20"
24"	6	13	27	65	37	76	127	24"
30"	8	16	32	78	45	93	156	30"
36"	9	18	38	92	53	110	185	36"

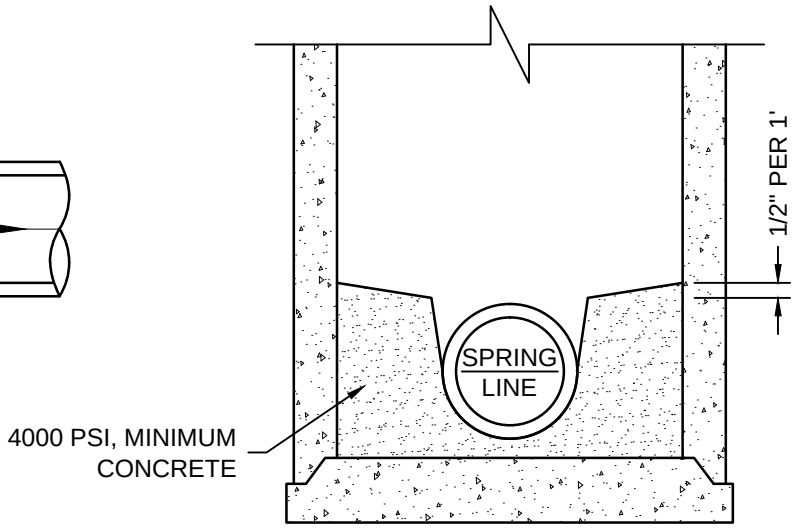
TEE BRANCH RESTRAINT (ASSUMED RESTRAINT OF "RUN" PIPE IS 20' EACH SIDE OF TEE)											
TEE BRANCH DIAMETER											
TEE RUN DIA.	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	TEE RUN DIA.
4"	0										4"
6"	0	0									6"
8"	0	0	0								8"
10"	0	0	0	0							10"
12"	0	0	0	0	0						12"
16"	0	0	0	0	0	13					16"
20"	0	0	0	0	0	0	33				20"
24"	0	0	0	0	0	0	17	52			24"
30"	0	0	0	0	0	0	0	33	81		30"
36"	0	0	0	0	0	0	0	14	65	110	36"

NOTES:

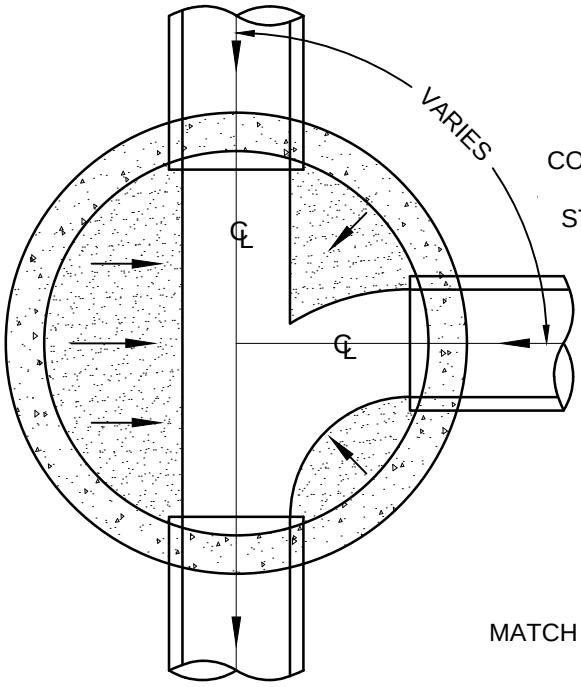
1. ASSUMPTIONS: PROJECT ENGINEER RESPONSIBLE TO VERIFY ALL ASSUMPTIONS & ADJUST LENGTHS ACCORDINGLY.
   1.1 PVC PIPE
   1.2 DESIGN / TEST PRESSURE = 150 PSI
   1.3 SAFETY FACTOR = 1.5 (RECOMMENDED BY DIPRA)
   1.4 TYPE 3 LAYING CONDITION (RECOMMENDED BY DIPRA)
   1.5 5' COVER
   1.6 SOIL / BACKFILL CONDITIONS = CLAY 2 (ADJUST TO BE REPRESENTATIVE OF ACTUAL FIELD CONDITIONS)
2. CALCULATED RESTRAINT LENGTHS ARE FOR EACH SIDE OF THE FITTING. ALL FITTINGS SHALL BE RESTRAINTED THE CALCULATED LENGTH AT A MINIMUM.
3. IF FITTINGS ARE IN CLOSE PROXIMITY AND RESTRAINT LENGTHS OVERLAP, REFER TO DIPRA DESIGN MANUAL FOR RESTRAINED LENGTH CALCULATIONS FOR ENCROACHMENT APPLICATIONS.

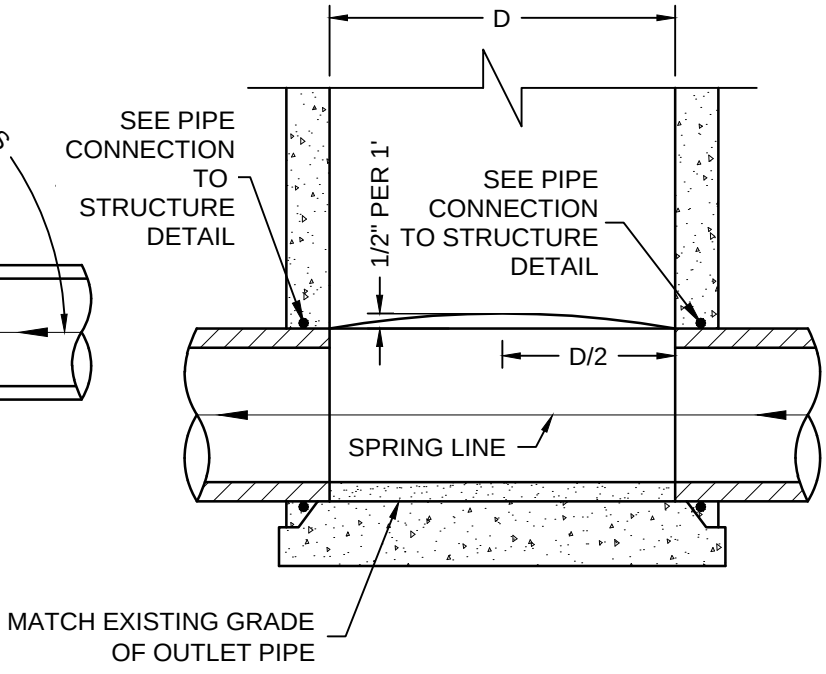
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	SAN-39	PVC THRUST RESTRAINT CALCULATIONS
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



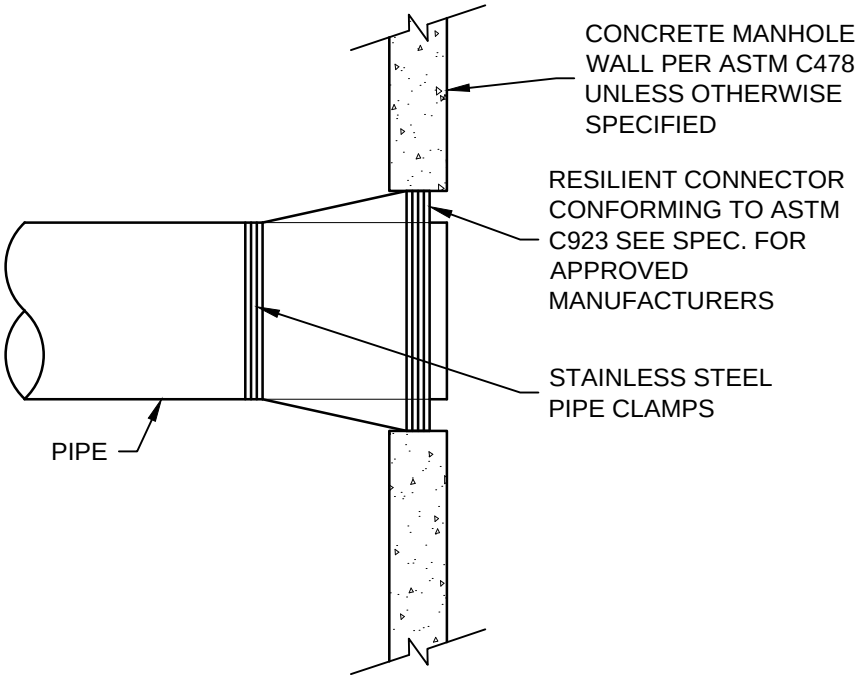


DROP, END, OR STEP-UP MANHOLE





Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-01	POURED CHANNEL SHAPES	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

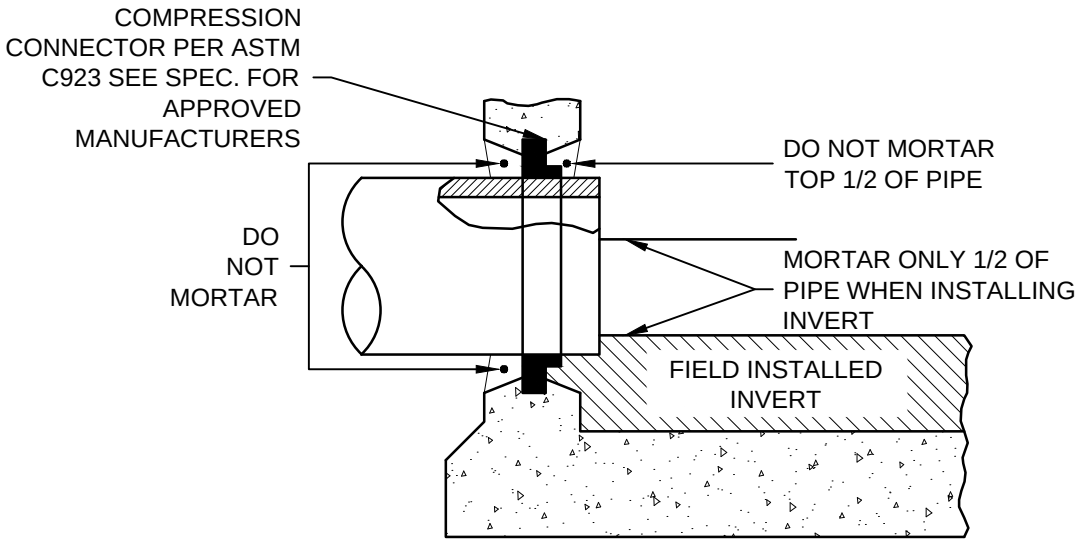


BOOT TYPE

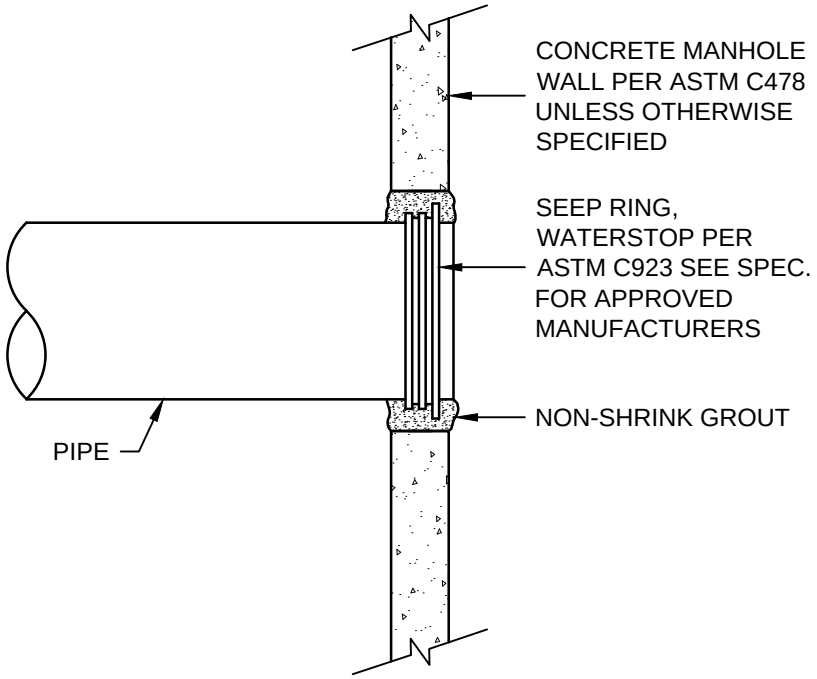
CAUTION:

1. WHEN INSTALLING PIPE STUBS FOR FUTURE PIPELINE, INSTALLATION OF ALL STUBS SHOULD BE PROPERLY RESTRAINED TO PREVENT ANY MOVEMENT.
2. TYPICAL APPLICATION IS FOR PIPES 36" IN DIAMETER OR SMALLER.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-02	BOOTED PIPE CONNECTION TO STRUCTURE	
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE	



COMPRESSION TYPE CAST IN PLACE

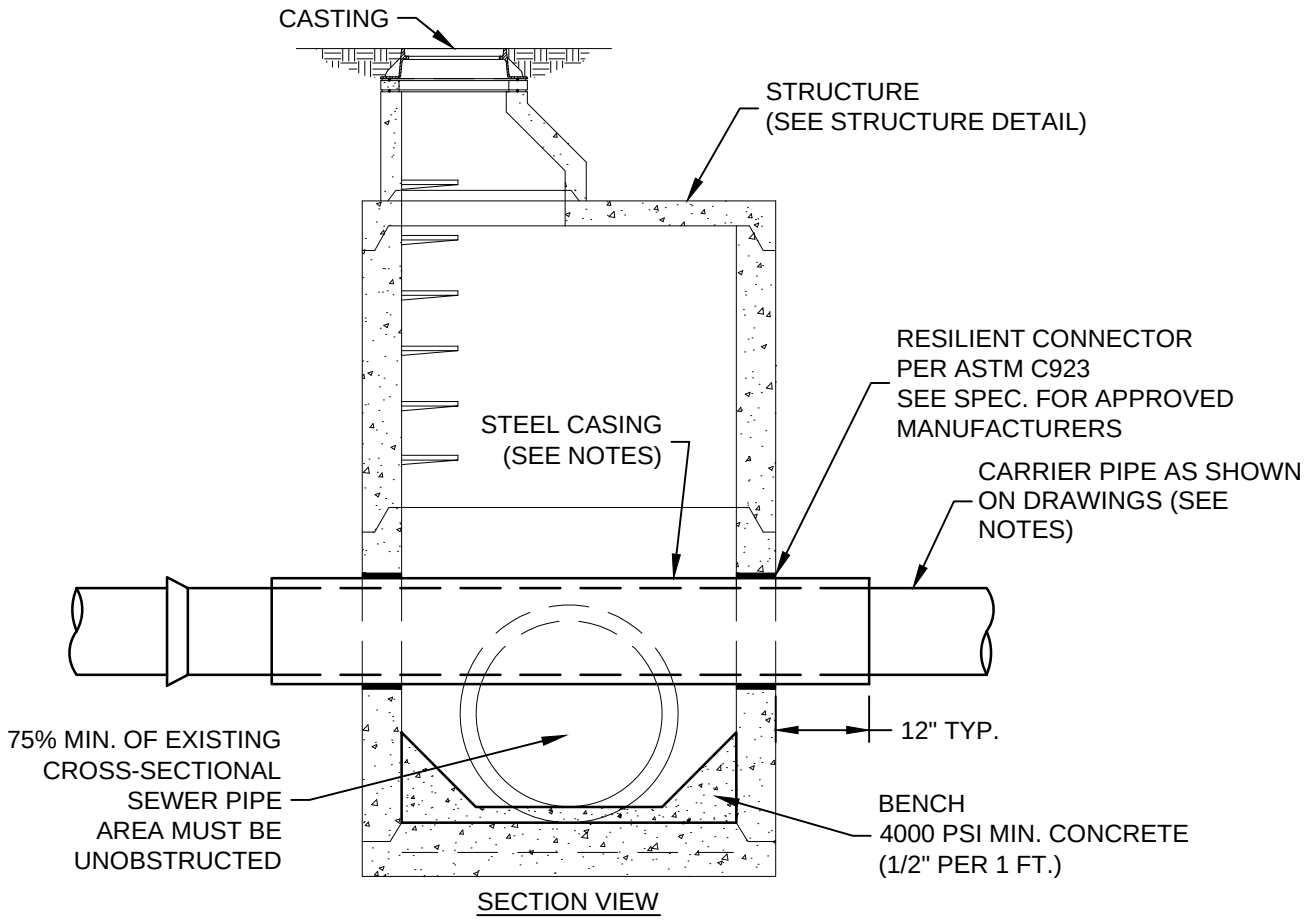


COMPRESSION TYPE GROUT IN PLACE

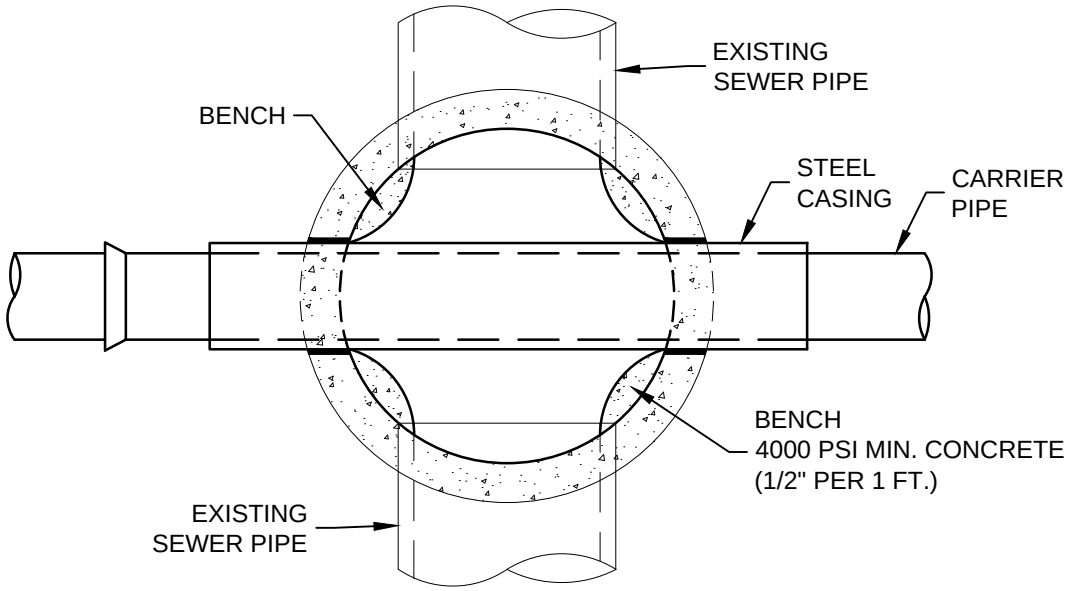
NOTES:

1. WHEN INSTALLING PIPE STUBS FOR FUTURE PIPELINE, INSTALLATION OF ALL STUBS SHOULD BE PROPERLY RETRAINED TO PREVENT ANY MOVEMENT.
2. TYPICAL APPLICATION IS FOR PIPES LARGER THAN 36".

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-03	COMPRESSION PIPE CONNECTION TO STRUCTURE
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



SECTION VIEW

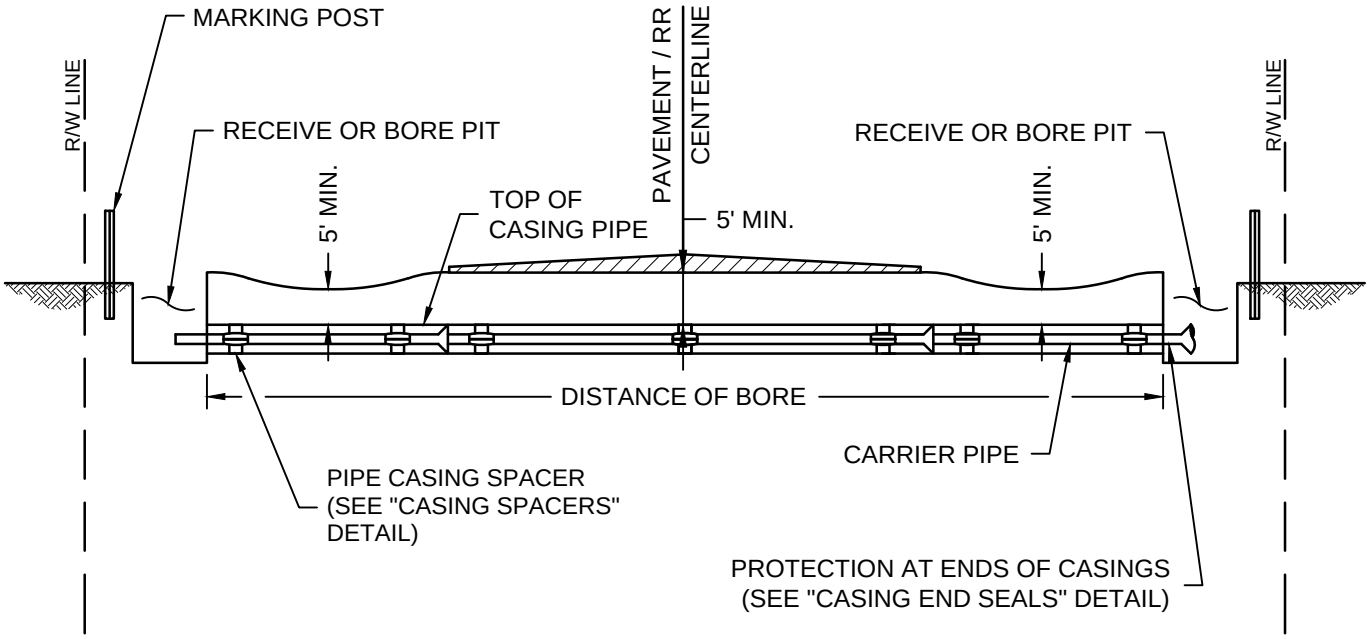


PLAN VIEW

NOTES:

1. STEEL CASING REQUIRED ON A CASE BY CASE BASIS PER OWNER / ENGINEER.
2. DUCTILE IRON PIPE SHALL BE USED FOR CROSSING PIPE IF CASING IS NOT USED.
3. CASING SPACERS SHALL BE USED WITH STEEL CASING. REFER TO CASING SPACERS DETAIL.
4. IT IS PREFERRED TO HAVE THE SANITARY SEWER PIPE RUN THROUGH THE MANHOLE (AS CARRIER PIPE) WHEN POSSIBLE.

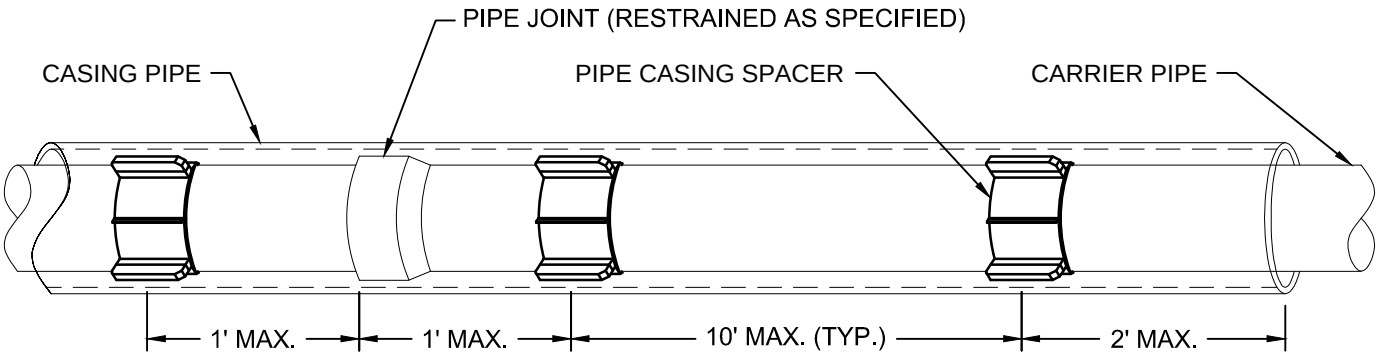
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-04	CONFLICT STRUCTURE
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



NOTES:

1. JOINTS MAY REQUIRE RESTRAINT WITHIN CASING IF SPECIFIED.
2. TRACING WIRE TO BE INSTALLED THROUGH ALL CASED BORINGS.
3. STEEL PIPE CASING SHALL CONFORM TO THE REQUIREMENTS OF ASTM A283, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED INTERIOR JOINTS SHALL BE GROUND TO A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C206, "AWWA STANDARD FOR FIELD WELDING OF STEEL WATER PIPE." COATING FOR STEEL CASING NOT REQUIRED.
4. STEEL PIPE CASING SHALL BE INSTALLED SYMMETRICAL ABOUT PIPE CENTERLINE (TYP). PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
5. CASING ONLY TO BE FILLED WITH SAND OR GROUT WITH APPROVAL BY OWNER / ENGINEER.

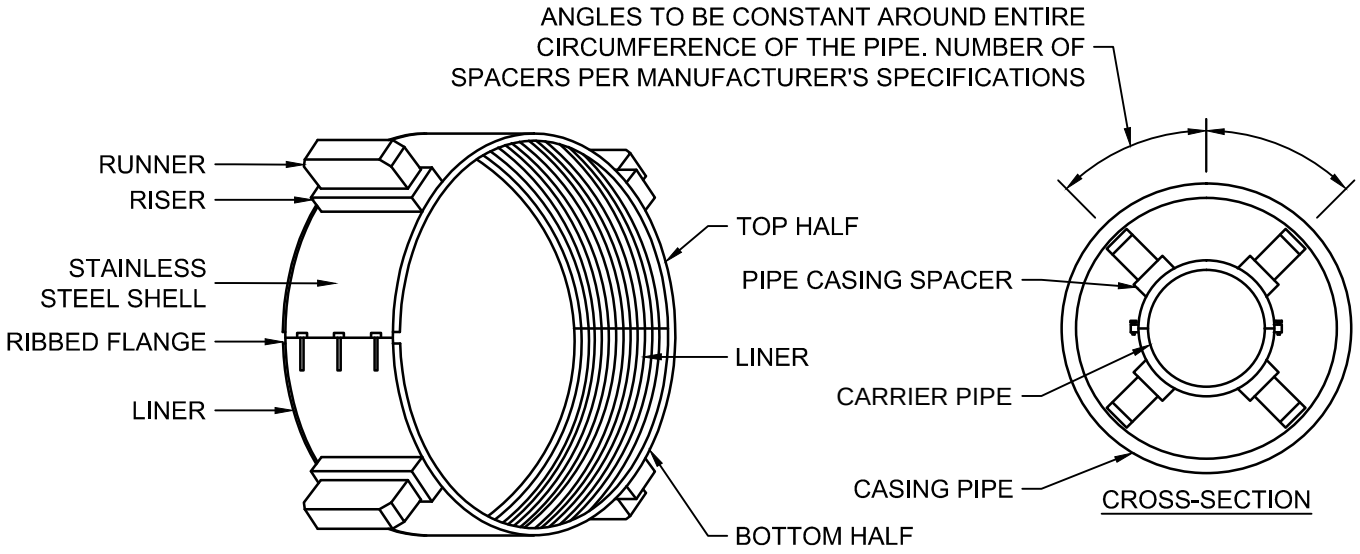
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-05	TYPICAL JACKED & BORED CASING PIPE	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE



CARRIER PIPE		
PIPE SIZE	CASING O.D.*	THICKNESS **
6"	16"	1/4"
8"	18"	1/4"
10"	20"	5/16"
12"	24"	3/8"
16"	30"	1/2"
18"	30"	1/2"
20"	36"	1/2"
24"	42"	1/2"

* PROJECT ENGINEER RESPONSIBLE TO CONFIRM APPROPRIATE CLEARANCES FOR FLANGES / BELLS; SUBJECT TO TOWN REVIEW.

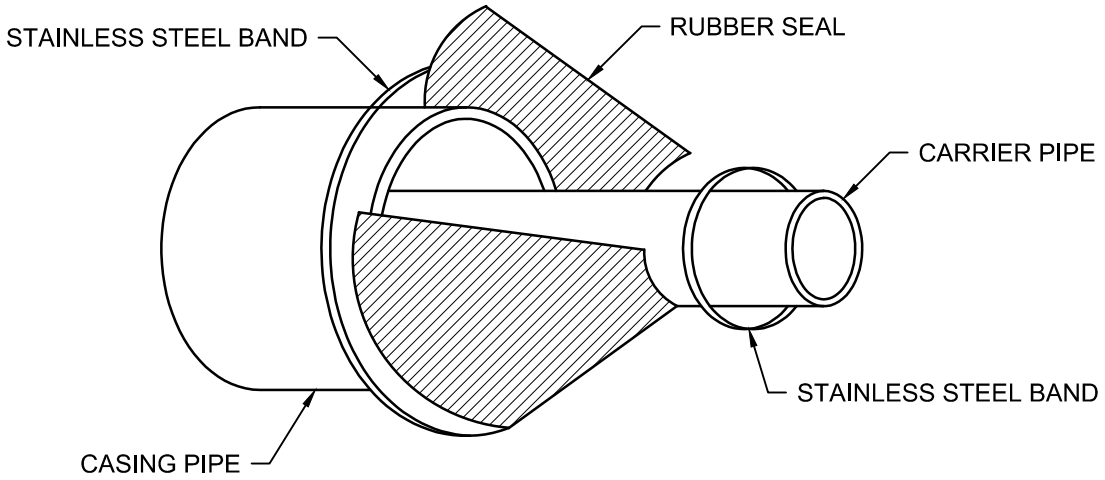
** PROJECT ENGINEER RESPONSIBLE TO COORDINATE WITH INDOT / RAILROAD / AUTHORITY HAVING JURISDICTION; SUBJECT TO TOWN REVIEW.



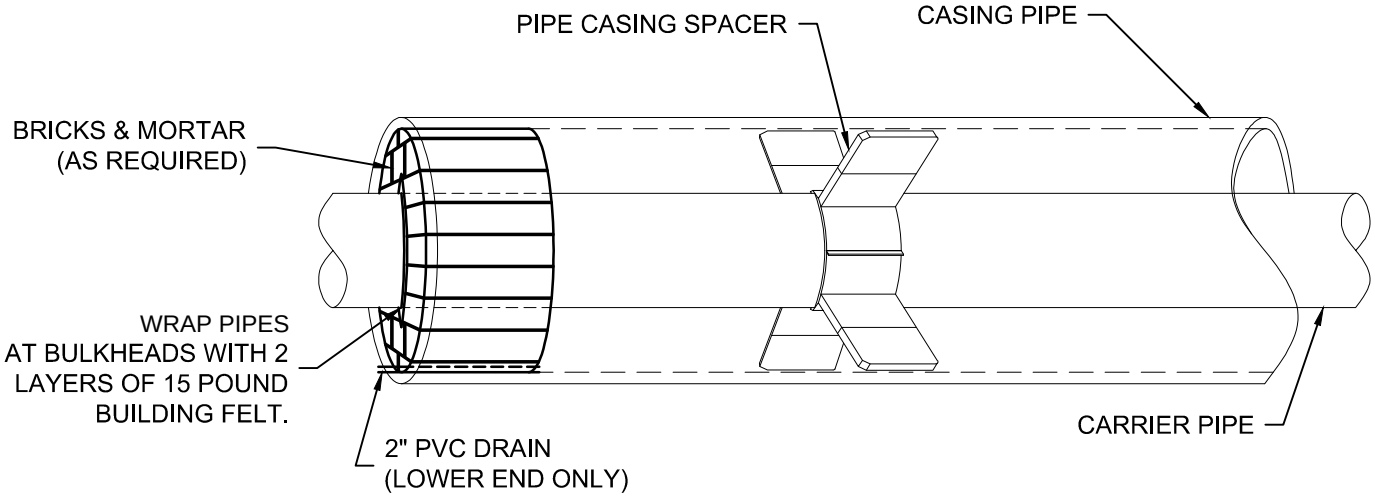
NOTES:

1. CASING SPACERS SHALL BE CCS SERIES BY CASCADE WATERWORKS MFG. ALTERNATE CASING SPACERS MAY BE USED WITH PRIOR APPROVAL FROM OWNER / ENGINEER.
2. TOWN APPROVED CASING SPACERS AND END SEALS SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS. USE A "CENTERED" CONFIGURATION AND PROVIDE THE MANUFACTURER WITH THE FOLLOWING INFORMATION: CARRIER PIPE O.D., CASING PIPE I.D., AND CASING LENGTH.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-06	CASING SPACERS
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:
			SCALE: NONE



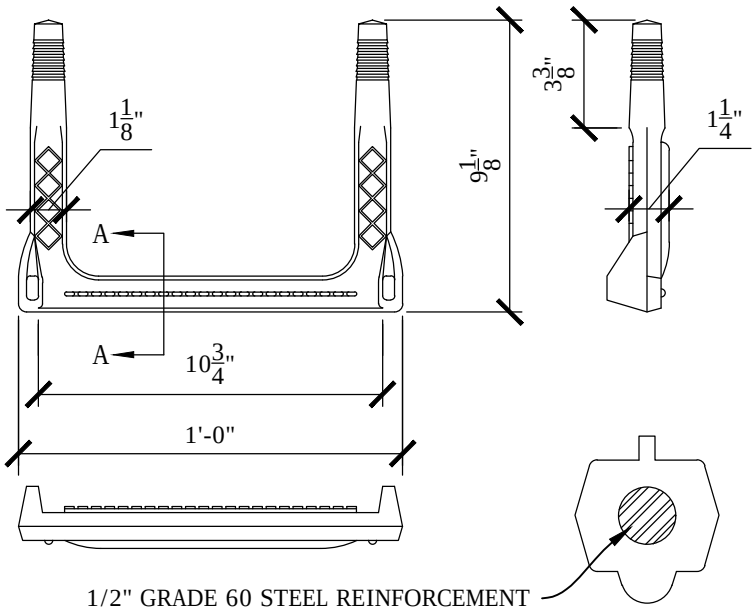
RUBBER END SEAL (3" DIAMETER AND SMALLER CARRIER PIPE)



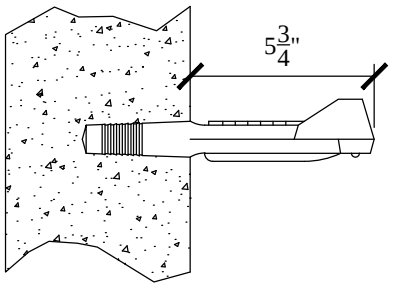
BRICK AND MORTAR END SEAL (4" DIAMETER AND LARGER CARRIER PIPE)

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-07	CASING END SEALS	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE

REINFORCED PLASTIC



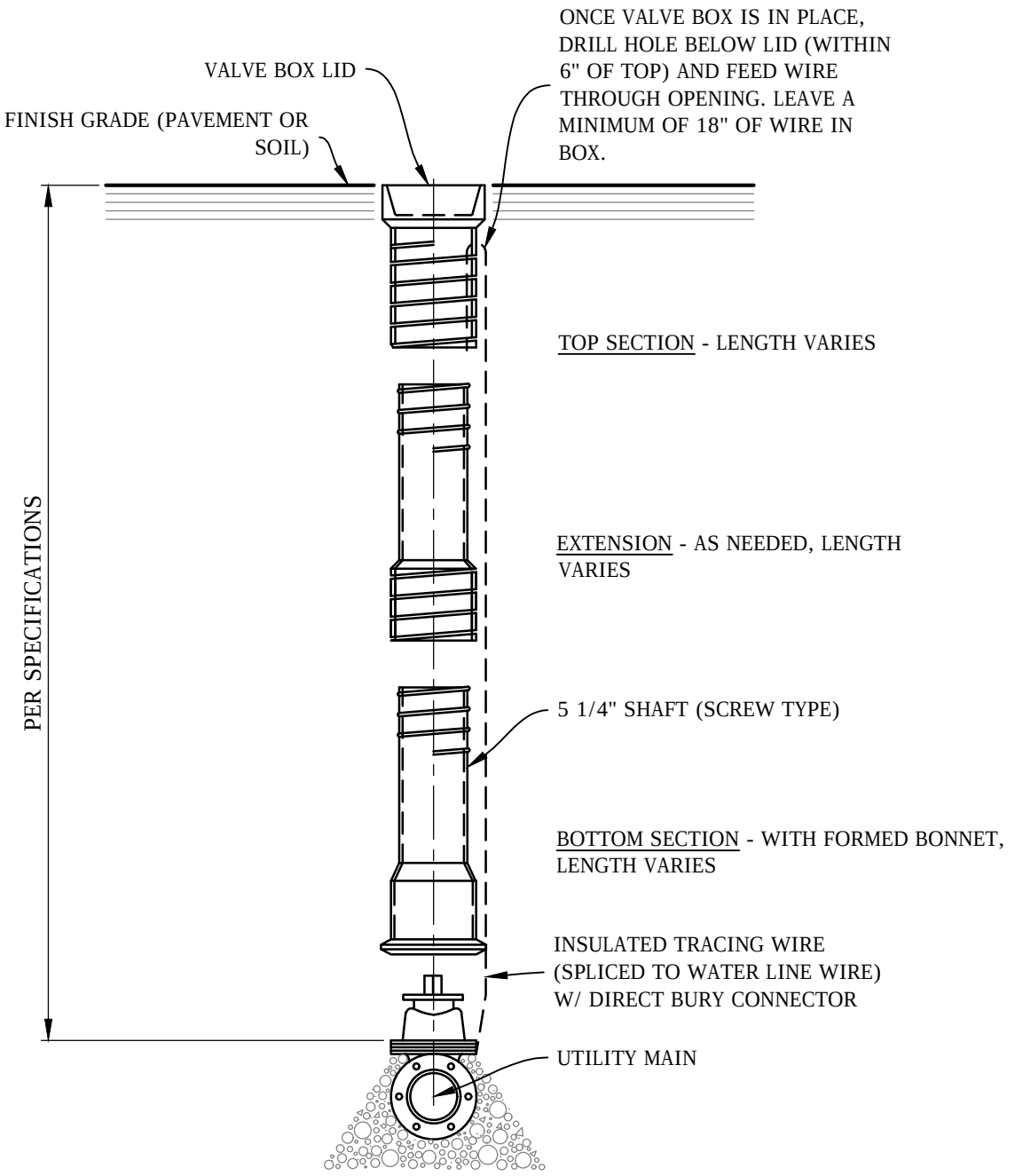
SECTION A-A



NOTES:

1. STEPS SHALL BE IN ACCORDANCE WITH ASTM C-478 LATEST EDITION.
2. ALTERNATIVE STEPS MAY BE SUBMITTED FOR APPROVAL AT DISCRETION OF TOWN.

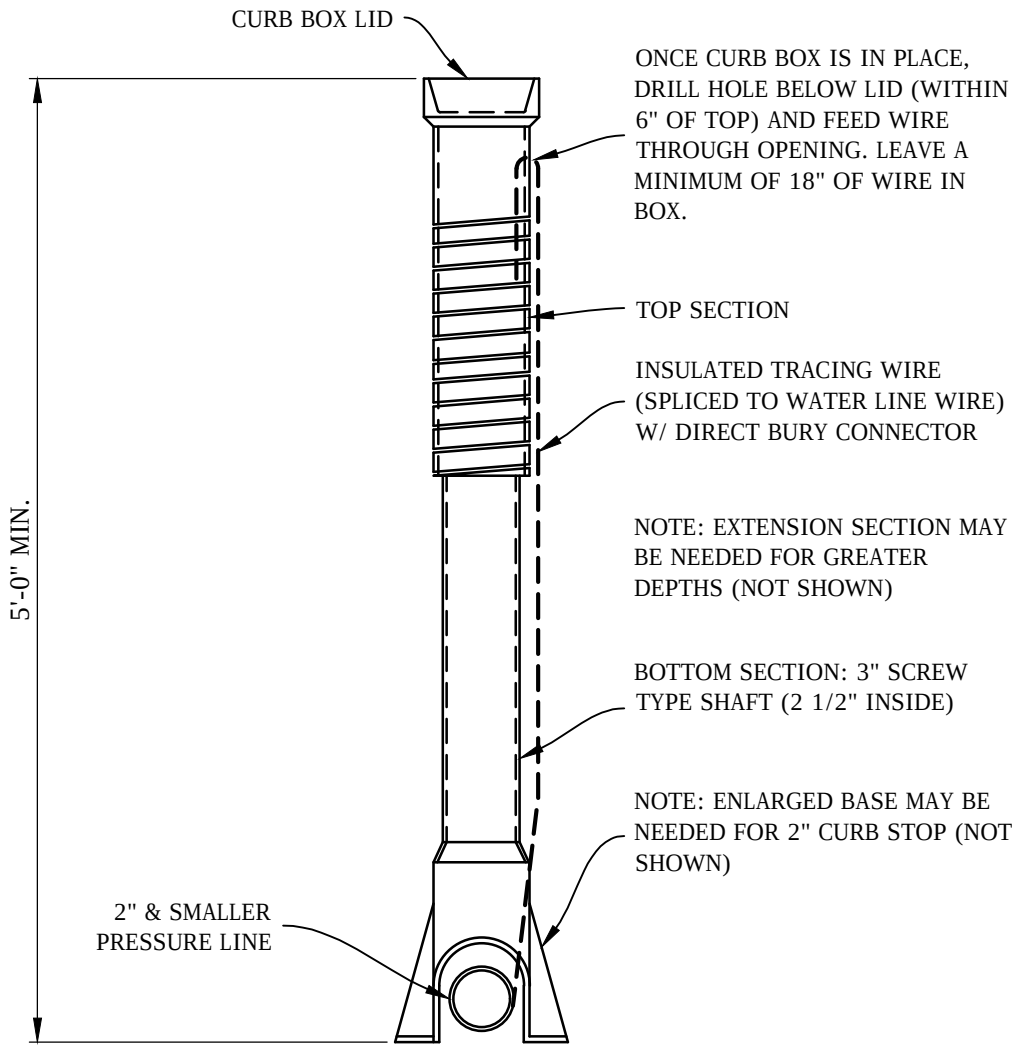
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-08	STANDARD MANHOLE STEPS	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED



NOTES:

1. ALL VALVE BOXES SHALL BE CAST IRON, BUFFALO SCREW STYLE WITH THE WORD "WATER" OR "SEWER" CAST IN THE LID AS APPROPRIATE.
2. VALVE BOX SHALL BE TWO OR THREE PIECE TYPE WITH A ROUND BASE AND 5 1/4" SHAFT SIZE.
3. PROVIDE POSI-CAP ALIGNMENT DEVICE PER SPECIFICATIONS.

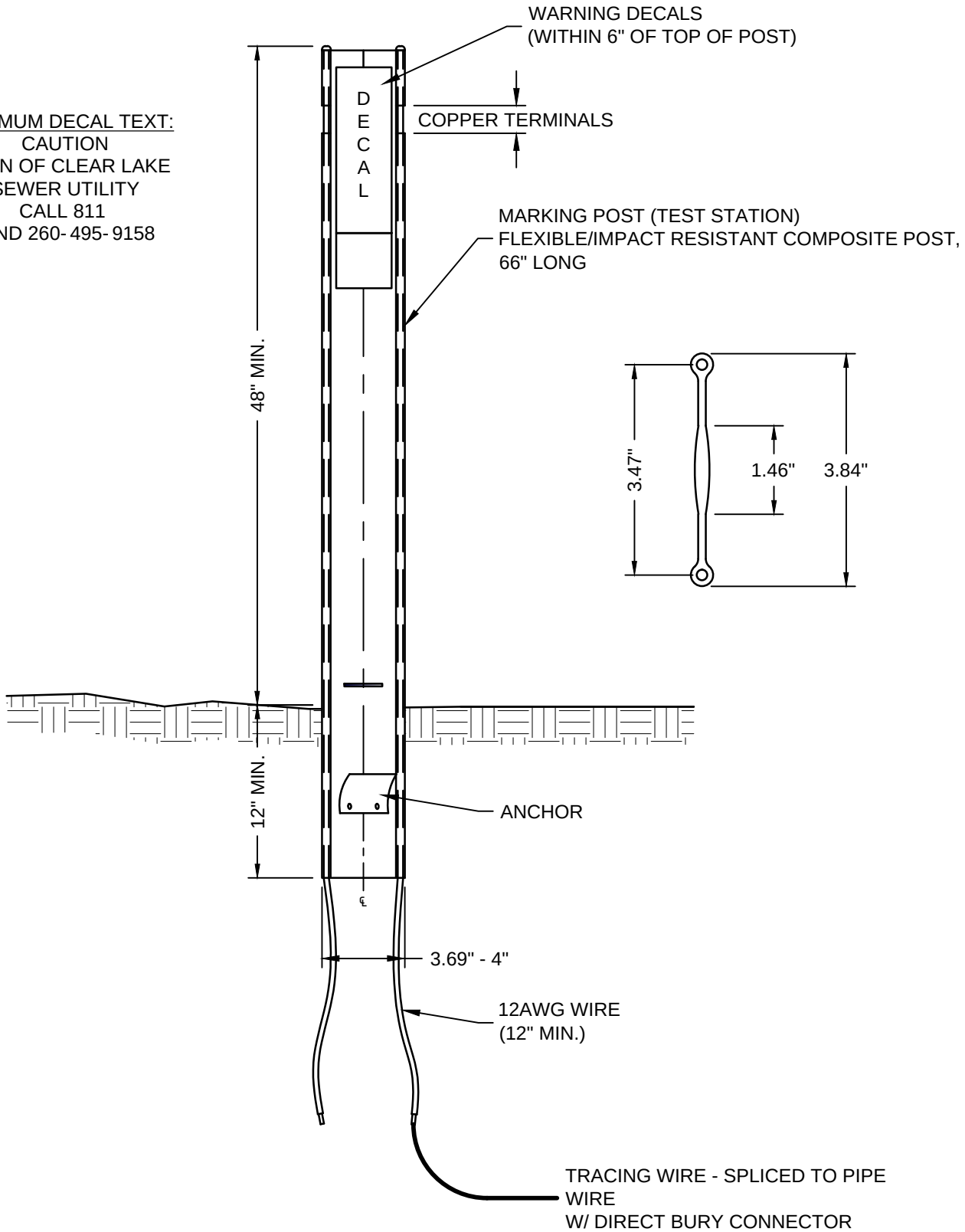
Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-09	VALVE BOX	
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: AS NOTED



NOTES:

1. ALL CURB BOXES SHALL BE CAST IRON, BUFFALO SCREW STYLE WITH THE WORD "WATER" OR "SEWER" CAST IN THE LID AS APPROPRIATE.
2. CURB BOX SHALL BE TWO PIECE TYPE WITH A 3" SHAFT SIZE (2 1/2" INSIDE).
3. THE LID SHALL BE HELD IN PLACE BY A STANDARD BRASS PENTAGON HEAD SCREW.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-10	CURB BOX
	STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED: SCALE: AS NOTED



NOTES:

1. MARKING POST REQUIRED AT THE ENDS OF ALL CASING BORES.
2. MARKING POST REQUIRED AT ALL AIR RELEASE STRUCTURES, SYSTEM ISOLATION VALVES, FLUSHING CONNECTIONS, AND EVERY 1000' IN UNDEVELOPED AREAS.
3. MARKING POSTS MAY BE REQUIRED ELSEWHERE AT THE DISCRETION OF THE TOWN.

Town of Clear Lake EST. 1932	TOWN OF CLEAR LAKE 111 GECOWETS DRIVE FREMONT, IN 46737	STC-12	MARKING POST
STANDARD DRAWINGS	APPROVED: 08/14/17	REVISED:	SCALE: NONE